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Geologic-point attributes for digital geologic-map data bases produced by the  
Southern California Areal Mapping Project (SCAMP)  
Version 1.0

By

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## **Geologic-point attributes for digital geologic-map data bases produced by the Southern California Areal Mapping Project (SCAMP)**

Version 1.0

For use with markerset "geoSCAMP2.mrk"

By

J.C. Matti, F.K. Miller, R.E. Powell, S.A. Kennedy, T.P. Bunyapanasarn, C. Koukladas,  
R.M. Hauser, and P.M. Cossette

This document provides geologic attributes and associated codes for points defined in digital geologic-map coverages produced by the Southern California Areal Mapping Project (SCAMP)--a geologic-mapping project sponsored jointly by the U.S. Geological Survey and the California Division of Mines and Geology. The attributes provide information about (1) point type (geologic-structure symbols, observation stations, and cartographic symbols that denote the character of geologic contacts, faults, and folds); (2) geologic age; (3) compiled versus original data; (4) data source for compiled information; and (5) other attributes that characterize the properties, origin, and history of geologic-point features in southern California.

SCAMP's data-base structure and digital attributes anticipate Nationwide standards currently being developed under the auspices of the U.S. Geological Survey's National Cooperative Geologic Mapping Program (NCGMP). The NCGMP is working in conjunction with the State geological surveys and other entities to develop a national geologic-map data model that will describe the format, storage, and use of geologic-map data in a computer. Included in this model will be National spatial-data standards for geologic polygons, lines, and points. These national standards eventually will become a foundation of the Nation's geologic-map data base, currently under development by the U.S. Geological Survey and the State geological surveys (Soller and Berg, 1997). Information about model development and other aspects of the data-base project can be found at <http://ncgmp.usgs.gov/ngmdbproject>. Pending widespread review and adoption of the national standards, SCAMP's digital geologic-map data bases are developed as provisional data structures that can easily be integrated into the national model when it is adopted for nationwide use.

### **Intended purpose**

This document targets two audiences: (1) users of Geographic Information Systems (GIS) who have little or no geologic training but who need to incorporate geologic-map information into their geospatial analyses; and (2) fellow geologists in the southern California region who, like ourselves, are struggling to convert their traditional analog geologic-map products into digital GIS data bases without the benefit of extensive GIS training. The GIS specialist hopefully will benefit from our brief discussion of geologic-map units; the geologic specialist hopefully will benefit from our brief discussion of how we use GIS rules and procedures to develop SCAMP digital geologic-map data bases. Hopefully, our cursory treatment of these two specialties will allow geologist and GIS analyst to work together as they use digital geologic maps produced by SCAMP.

## **GEOLOGIC-POINT ATTRIBUTES**

A geologic map uses a combination of lines, colored areas, and points to portray the geologic framework of a prescribed geographic region. The geologic framework will include various kinds of earth materials (geologic units) separated from each other at the time of their formation by various kinds of boundaries (geologic contacts) and subsequently modified by various kinds of geologic structures (faults, folds) that have broken or warped the geologic units. Many units possess small-scale geologic structures that developed when the unit formed (structures such as bedding, sedimentary laminations, igneous flow features) or during deformations imposed on it during or after its formation (structures such as small-scale folds, lineations, foliations). Geologists describe and measure these structures at specific locations, and then record the information as part of the geologic map using various symbols. This type of information is referred to as geologic-point data. This document discusses rules and procedures used by SCAMP to assign digital attributes and cartographic symbols to these point data.

Geologic points described in this document convey three main attributes: (1) feature type, (2) how numerical-measurement data were obtained, and (3) relative age in a sequence of geologic events. These three attributes are conveyed in two ways: they are coded into the digital data base for search-and-retrieval purposes, and they are expressed graphically in map plots through the use of various symbols and ornaments.

## FEATURE TYPE

Planar geologic structures

Many geologic structures form two-dimensional planes that can be observed or inferred in geologic outcrops. Examples include sedimentary or volcanic bedding; igneous and metamorphic foliation; jointing; cleavage; and fold axial planes. Planar geologic features have two main parameters that describe their orientation: the *strike* of the feature (defined to be the azimuthal trend of the line formed by the intersection of a tilted plane with a horizontal datum) and the *dip* of the feature (defined to be the inclination of a tilted plane measured in a direction perpendicular to its strike).

*Bedding attitude.*--Bedding attitude refers to the orientation of layering in sedimentary deposits and in some volcanogenic deposits. Here, the two-dimensional planar feature is the boundary surface between individual layers. When they originally are deposited, most sedimentary and volcanogenic layers are horizontal; however, when warped by folds or tilted by faults, layers that originally were horizontal can be tilted into inclined, vertical, or even overturned orientations. For each bedding type, the following orientations require digital attribution and graphical symbolization:

Horizontal bedding  
Inclined bedding  
Vertical bedding  
Overturned bedding

A critical attribute of layered sedimentary and volcanogenic deposits is their right-side-up *versus* overturned orientation. Sedimentary and some volcanogenic materials typically are deposited in horizontal layers where the base of each succeeding layer overlies the top of the preceding layer. Through time this process leads to a stacked succession of horizontal layers, where the top layer in the succession is younger than the bottom layer and where layer tops face upward toward the top of the stacked sequence. Unfortunately, the right-side-up orientation of a layered sedimentary or volcanic sequence cannot be taken for granted because folding and faulting can overturn a layered sequence into an upside-down orientation. For any layered sequence, the geologist can determine right-side up only if information exists to document this attitude. Age determinations based on fossils, isotopic analyses, or magnetostratigraphic data obviously can indicate age trends within a layered sequence and thereby yield right-side-up direction. However, where age information is lacking (as it commonly is), right-side up in a layered rock sequence can be determined only if the geologist (1) recognizes unique layering patterns that elsewhere have been shown to be right-side up or (2) identifies unique geologic features that clearly indicate right-side up without the need for regional context. In the latter case, some sedimentary and volcanogenic materials have depositional features (e.g., cross laminations, sole marks, channelate bases) that have well-documented geometric relationships to the base or top of each layer. If these features are present in an outcrop, the geologist can determine with confidence the *facing direction* of layer tops--i.e., the right-side-up direction of the layering sequence. Once ascertained, information about facing direction can form a critical attribute of the geologic-point data base. For most areas mapped by SCAMP, the right-side-up orientation of layered rocks generally is well established from local and regional geologic conditions, and the geologist collects bedding-orientation data with the certain knowledge that the succession is right-side up. For such bedding attitudes, the right-side-up character of the bedding basically is a default condition assumed in the data base.

*Foliation attitude.*--Foliation attitude refers to the orientation of parallel planes defined by the consistent orientation or preferential concentration of flake-like or tabular mineral crystals. This foliation can be produced by igneous flow (flow foliation) or by the response of pre-existing and new-grown minerals to the strains imposed during metamorphism (schistose and gneissose foliation) and (or) brittle-ductile deformation (cataclastic and mylonitic foliation). For each foliation type, the following orientations require digital attribution and graphical symbolization:

Horizontal foliation  
Inclined foliation  
Vertical foliation

SCAMP geologic-map data bases describe and classify *high-strain fabrics* like cataclastic and mylonitic foliations separately from *metamorphic fabrics* like phyllitic, schistose, and gneissose foliations. Although geologists usually classify cataclastic and mylonitic rocks and their structures as metamorphic because of the textural and mineralogic changes that occur under dynamic high-strain conditions, we attribute and symbolize cataclastic and mylonitic structures as *strain-dominated elements* rather than as *metamorphic elements* in order to

be consistent with our classification of strain-dominated rocks separately from metamorphic rocks (see polygon attributes discussed in Matti and others, 1997).

*Joint attitude.*--Joint attitude refers to the orientation of parallel planes defined by rock fractures. These fractures are joints along which there has been no movement. Each of the following joint conditions requires digital attribution and graphical symbolization:

Horizontal joints  
Inclined joints  
Vertical joints

In addition, we distinguish between joints developed in sedimentary rocks and joints developed in igneous rocks.

*Cleavage attitude.*--Cleavage attitude refers to the orientation of numerous closely spaced parallel planes along which some rocks tend to split or cleave. Cleavage is defined by the consistent orientation of plate-like or tabular mineral crystals organized into distinct planes by strain and recrystallization. Each of the following cleavage conditions requires digital attribution and graphical symbolization:

Horizontal cleavage  
Inclined cleavage  
Vertical cleavage

*Fold axial-plane attitude.*--Axial-plane attitude refers to the orientation of the imaginary two-dimensional surface that connects the crests or troughs of folded layers in such a way that the sides or limbs of the fold are arranged more or less symmetrically around the axial surface. This definition applies both to outcrop-scale minor folds and to large mappable folds. Each of the following axial-plane orientations requires digital attribution and graphical symbolization:

axial-planes of folds that are upright  
axial-planes of folds that are overturned

Successive generations of fold development can be characterized in terms of fold generation (F1, F2, F3, etc., from older to younger).

#### Linear geologic structures

Many geologic structures are one-dimensional linear features (lineations) that can be observed or inferred in geologic outcrops. Examples include sedimentary and igneous lineations created by fluid flow and lineations produced by the deformation of rocks during folding, faulting, shearing, and metamorphism. Linear geologic features have two main parameters that describe their orientation: their *trend* (defined to be the azimuthal bearing of the vertical plane that holds the linear feature) and their *plunge* (defined to be the inclination of the linear feature measured in the direction of its trend).

*Sedimentary lineations.*--Lineations created by fluid flow as sediment is deposited;

*Igneous lineations.*--Lineations created by flow as molten or semi-molten igneous fluid cools;

*Metamorphic lineations.*--Lineations created by deformation and recrystallization during metamorphism;

*Deformation lineations.*--Lineations in rocks created by deformation;

- Fold-hinge lineations.--Lineations defined by hinge-line traces of minor folds;
- Fault-movement lineations.--Lineations created by fault-block movements along fault surfaces;
- Penetrative lineations.--Lineations created by pervasive deformation that yields mineral alignments, mineral rodding, and streaking of crushed minerals.

#### Symbols describing contact character, fault character, and fold character

Some point information associated with geologic contacts, faults, and fold-axis traces is non-analytical-- that is, it provides only descriptive information about the character of the linear geologic features. This descriptive point information is stored in the geologic-map data base, but not in the same GIS layer as the analytical structure data; the descriptive point data are displayed in graphics plots through the use of various cartographic symbols. Descriptive point data include such information as:

- the knife-edge *versus* gradational or transitional character of geologic contacts;
- information about faults, including graphical indicators of down-dropped block, right- or left-lateral movement of fault blocks, and the dip direction and amount for inclined fault planes;
- the nature of fold-axis traces, including information about fold geometry (antiformal or synformal, anticlinal or synclinal, refolded); axial-plane orientation (upright, overturned); and hinge line orientation (subhorizontal, plunging);

#### Symbols for observation stations

Many graphics plots have specialized symbols showing the location of observation stations and the type of information recorded at each station. Typical observation stations have information about lithologic and mineralogic composition determined from hand samples, thin sections, or stained slabs; information about pedogenic soils; paleocurrent measurements; and fossil locations. As with the non-analytical point data, observation-station data are inbedded in the geologic-map data base but

#### METHODS USED TO DETERMINE STRUCTURAL DATA

In most cases, numerical values for the orientation of planar and linear geologic structures (integer values for strike, dip, plunge, trend) are obtained from measurements made directly on geologic outcrops. However, for logistical reasons some outcrops cannot be visited, and structural parameters must be approximated based on estimates made remotely using binoculars or aerial photographs. SCAMP point data are attributed so that the method of determination for each structural point is identified:

- strike and dip measured at site;
- strike and dip direction estimated but not measured (dip amount estimated);
  - estimated from aerial photographs;
  - estimated from binocular observation;
- strike and dip direction indicated but not estimated (direction of dip indicated, no dip amount determined);

#### RELATIVE GEOLOGIC AGE

SCAMP geologic-point data bases include a provision for assigning a geologic age to structural data, as appropriate. For example, for a sedimentary bedding attitude whose inclined orientation was attained during late Miocene folding, the bedding attitude can be attributed so that the late Miocene age of the tilting event is recorded in the geologic-point data base. Or, for a foliation attitude whose orientation was attained during late Cretaceous metamorphism, the foliation attitude can be attributed so that the late Cretaceous age of the metamorphic event is recorded in the geologic-point data base.

#### **CARTOGRAPHIC STANDARDS FOR POINT SYMBOLS IN PLOT FILES**

Reynolds and others (1995) produced a comprehensive catalogue of geologic-point and geologic-line symbols that proposes technical standards for these elements. Although we have adopted many of the technical standards proposed in that catalogue, the geologic complexity in southern California required that we depart from the symbology proposed by Reynolds and others (1995): first, we created additional point symbols and second, we associated some of their symbols with different geologic features.

We document SCAMP's point-and-symbol usage in two parts of this report:

- On p. 7-24 we display pictures of each point type together with its coded definition and explanation;

- A graphics plot accompanying this pamphlet illustrates each point type as assembled in the marker set "geoSCAMP2.mrk"; these point types are referenced in SCAMP geologic-map coverages using the data-base field P-SYMB.

## DATA-BASE STRUCTURE

Point attributes in SCAMP geologic maps are assembled in ARC/INFO<sup>1</sup>, but the attribute data easily can be exported into other database packages (such as Oracle, Ingres, or Access). The data-base architecture has two features:

- a small number of data-base fields, each containing short code sentences that store the attributes;
- a linguistic root-suffix coding scheme that emphasizes relations among *related* attributes but allows clear separation among *non-related* attributes;

A typical data-base field will contain a code sentence comprising root-suffix codes parsed by dots. For example:

.BEDS.VERB.FADT.SDPM.ORG.

is a code sentence for a structural-point feature (bedding attitude) having the attributes of "sedimentary bedding.vertical.tops of beds determined from facing structures.strike and dip measured at site.original data.". In this example, the root-suffix code .BEDS. denotes a data point for sedimentary bedding. The code is built from the root .BED (bedding) and the suffix "S" (sedimentary). Next in the code string, .VERB. denotes "vertical bedding". The code is built from the root .VER. (orientation of planar or linear element, vertical) and the suffix "B" (bedding). Next in the code string, .FADT. is the root-suffix code for "facing direction, tops of beds determined". The code is built from the root .FAD (facing direction) and the suffix "T" (tops of beds determined). Next in the code string, .SDPM. is the root-suffix code for "strike and dip measured at site". The code is built from the root .SDP (strike-and-dip direction) and the suffix "M" (measured at site). These root-suffix codes allow attribution or selection of the following attributes:

- the family of all bedding-attitude points (.BED), without distinction between sedimentary bedding and volcanogenic bedding (facilitated by the absence of a terminal parsing dot);
- sedimentary bedding-attitude points (.BEDS.), excluding volcanogenic bedding-attitude points (.BEDV.);
- the family of all planar structural-attitude points that have vertical orientations (.VER root), irrespective of whether these points are bedding, foliation, cleavage, or joints (facilitated by the absence of a terminal parsing dot);
- structural-attitude points that have vertical orientations (.VERB.) distinct from those that have horizontal, inclined, or overturned orientations;
- the family of all planar structural-attitude points that have information about facing direction (.FAD root), whether facing direction is determined or unknown (facilitated by the absence of a terminal parsing dot);
- planar structural-attitude points for which bedding tops have been determined using facing-direction features (.FADT.);
- the family of all planar structural-attitude points for which information exists about how the strike-and-dip determination was made (.SDP root) (facilitated by the absence of a terminal parsing dot);
- planar structural-attitude points for which strike-and-dip measurements have been made at the attitude site (.SDPM.);

Note that data-base searches using the last two codes yield very different results even though they employ nearly identical codes: a search for .BED lacking the terminal parsing dot yields all bedding attitudes for both sedimentary and volcanogenic geologic materials, whereas a search for .BEDS. having the terminal parsing dot yields bedding attitudes only for sedimentary geologic materials.

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<sup>1</sup>Use of any trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Using the root-suffix code sentences, the following kinds of attributes might be selected for in the appropriate data base fields:

- inclined sedimentary bedding (<35°, for example) compiled from non-USGS SCAMP sources;
- overturned volcanogenic bedding estimated from binocular determinations by USGS SCAMP sources;
- inclined sedimentary bedding (<35°, for example) compiled from non-USGS SCAMP sources;

Through the use of code sentences built up from root-suffix code bits, SCAMP data bases use a combination of embedded data-base fields and relational data-base fields to store digital point attributes. For each SCAMP geologic-map data base, point data intended for numerical analysis are stored in the GIS coverage entitled STRUCTURE; point data that are descriptive and informational are stored in the GIS coverage called ANOTATION.

Tables 1 and 2 describe the relevant geologic-point data-base fields:

<b>DATA-BASE FIELDS EMBEDDED IN .pat FILE (STRUCTURAL-POINT COVERAGE)</b>		
<b>.pat data-base field</b>	<b>Explanation</b>	<b>Contents</b>
<b>P-TAG</b>	Point tag	P-TAG is the relate item that links points to their default definitions in the relate table "POINTS.REL". P-TAG also is a convenient tag attached to each point type for ease in attributing and editing the coverage. P-TAG is not the point definition or the marker-set number.
<b>P-STRIKE</b>	Point strike	P-STRIKE is an integer data-base field that contains the azimuthal trend of planar and linear geologic structures. Integer data embedded in this field can be used for quantitative analysis
<b>P-DIP</b>	Point dip	P-DIP is an integer data-base field that contains the dip amount of inclined planar and linear geologic structures. Integer data embedded in this field can be used for quantitative analysis
<b>P-SYMB</b>	Point graphic	P-SYMB calls up the appropriate point-type from the marker set "geoSCAMP2.mrk"
<b>P-AGE</b>	Geologic-point age	P-AGE indicates the geologic age that is assigned to geologic-point features where their age has been determined
<b>P-AGECON</b>	Age confidence	P-AGECON indicates the confidence with which a geologic age is assigned to geologic point features
<b>P-UNIQUE</b>	Unique attributes	P-UNIQUE provides attributes that are assigned to specific geologic-point features where appropriate
<b>P-SOURCE</b>	Point source	P-SOURCE provides attribution for point data compiled from sources other than the U.S. Geological Survey authors of this map product (e.g., Allen, 1957)

Table 1



<b>DATA-BASE FIELDS IN "POINTS.REL"</b>		
"POINTS.REL" provides the default coded definition and explanation for all geologic points that exist in SCAMP geologic-map data bases. "POINTS.REL" contains the following data-base fields:		
<b>.pat data-base field</b>	<b>Explanation</b>	<b>Contents</b>
<b>P-TAG</b>	Point tag	P-TAG is the relate item that links P-DEF in the relate table "POINTS.REL" to points in the .pat file.
<b>P-DEF</b>	Point definition	P-DEF provides the coded definition for each point-type (for example, .BEDS.VERB.FADT.SDPM.ORG.). P-DEF is the default core definition for each point type. P-DEF also is the main data-base field used for searching the coverage for points having a particular attribute or attributes.
<b>P-EXP</b>	Point explanation	P-EXP provides an explanation for the coded definition for each point-type (for example, ".bedding.sedimentary.vertical.bedding.facing structures determined.strike and dip measured at site.original data." is the explanation for the code string above). P-EXP is not intended to be a searchable data- base field

Table 2













The remainder of this document lists geologic points and their associated codes used in geologic-map coverages produced by the Southern California Areal Mapping Project. Appendix A provides INFO command-line narratives that allow the data base to be searched for one or more specific attributes; Appendix A also provides some examples of completed data bases for representative points developed in the coverages.

#### REFERENCES CITED

- Matti, J.C., Miller, F.K., Powell, R.E., Kennedy, S.A., and Cossette, P.M., 1997a, Geologic-polygon attributes for digital geologic-map data bases produced by the Southern California Areal Mapping Project, version 1.0: U.S. Geological Survey Open-File Report 97-860, 180 p.
- Matti, J.C., Powell, R.E., Miller, F.K., Kennedy, S.A., Ruppert, K.R., Morton, G.L., and Cossette, P.M., 1997b, Geologic-line attributes for digital geologic-map data bases produced by the Southern California Areal Mapping Project, version 1.0: U.S. Geological Survey Open-File Report 97-861, 96 p.
- Reynolds, M.W., Queen, J.E., and Taylor, R.B., 1995, Cartographic and digital standard for geologic map information: U.S. Geological Survey Open-File Report 95-525

Graphic	P-TAG point tag	P-SYMB (Marker-set ID)	Point definition [P-DEF] followed by point explanation in parentheses
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












**BEDDING STRUCTURAL SYMBOLS (.BED)****BEDDING IN SEDIMENTARY LAYERED ROCKS**






	B1	1	.BEDS.HRZB.SDPM.ORG. (.bedding.sedimentary.horizontal.strike and dip measured at site.original data.)
	B2	2	.BEDS.INCB.SDPM.ORG. (.bedding.sedimentary.inclined.strike and dip measured at site.original data.)
	B3	3	.BEDS.INCB.FADT.SDPM.ORG. (.bedding.sedimentary.inclined.top of beds determined from facing structures.strike and dip measured at site.original data.)
	B4	4	.BEDS.VERB.SDPM.ORG. (.bedding.sedimentary.vertical.strike and dip measured at site.original data.)
	B5	5	.BEDS.VERB.FADT.SDPM.ORG. (.bedding.sedimentary.vertical.top of beds determined from facing structures.strike and dip measured at site.original data.)
	B6	6	.BEDS.OVTB.SDPM.ORG. (.bedding.sedimentary.overturned.strike and dip measured at site.original data.)
	B7	7	.BEDS.OVTB.FADT.SDPM.ORG. (.bedding.sedimentary.overturned.top of beds determined from facing structures.strike and dip measured at site.original data.)
	B8	8	.BEDS.INCB.FADU.SDPM.ORG. (.bedding.sedimentary.inclined.facing unknown.strike and dip measured at site.original data.)
	B9	9	.BEDS.VERB.FADU.SDPM.ORG. (.bedding.sedimentary.vertical.facing unknown.strike and dip measured at site.original data.)
	B10	10	.BEDS.OVTB.FADU.SDPM.ORG. (.bedding.sedimentary.overturned.facing unknown.strike and dip measured at site.original data.)
	B11	11	.BEDSW.INCB.SDPM.ORG. (.bedding.sedimentary.wavy or crinkled.inclined.strike and dip measured at site.original data.)
	B12	12	.BEDSW.VERB.SDPM. (.bedding.sedimentary.wavy or crinkled.vertical.strike and dip measured at site.original data.)
	B13	13	.BEDSW.OVTB.SDPM.ORG. (.bedding.sedimentary.wavy or crinkled.overturned.strike and dip measured at site.original data.)

	B14	2	.BEDS.INCB.SDPAI.ORG. (.bedding.sedimentary.inclined.approximate.strike and dip direction indicated but not measured.original data.)
	B15	4	.BEDS.VERB.SDPAI.ORG. (.bedding.sedimentary.vertical.approximate.strike and dip direction indicated but not measured.original data.)
	B16	6	.BEDS.OVTB.SDPAI.ORG. (.bedding.sedimentary.overturned.approximate.strike and dip direction indicated but not measured.original data.)
	B17	14	.BEDS.INCB.SDPAE.ORG. (.bedding.sedimentary.inclined.approximate.strike and dip estimated.original data.)
	B18	15	.BEDS.VERB.SDPAE.ORG. (.bedding.sedimentary.vertical.approximate.strike and dip estimated.original data.)
	B19	16	.BEDS.INCB.SDPAEB.ORG. (.bedding.sedimentary.inclined.approximate.strike and dip estimated from binocular observation.original data.)
	B20	17	.BEDS.VERB.SDPAEB.ORG. (.bedding.sedimentary.vertical.approximate.strike and dip estimated from binocular observation.original data.)
	B21	18	.BEDS.INCB.SDPAEA.ORG. (.bedding.sedimentary.inclined.approximate.strike and dip estimated from aerial photographs.original data.)
	B22	19	.BEDS.VERB.SDPAEA.ORG. (.bedding.sedimentary.vertical.approximate.strike and dip estimated from aerial photographs.original data.)
	B23	20	.BEDS.INCB.CPD. (.bedding.sedimentary.inclined.compiled data.)
	B24	21	.BEDS.VERB.CPD. (.bedding.sedimentary.vertical.compiled data.)
	B25	22	.BEDS.OVTB.CPD. (.bedding.sedimentary.overturned.compiled data.)

## BEDDING IN VOLCANOGENIC LAYERED ROCKS


	B26	1	.BEDV.HRZB.SDPM.ORG. (.bedding.volcanogenic.horizontal.strike and dip measured at site.original data.)
	B27	2	.BEDV.INCB.SDPM.ORG. (.bedding.volcanogenic.inclined.strike and dip measured at site.original data.)
	B28	3	.BEDV.INCB.FADT.SDPM.ORG. (.bedding.volcanogenic.inclined.top of beds determined from facing structures.strike and dip measured at site.original data.)
	B29	4	.BEDV.VERB.SDPM.ORG. (.bedding.volcanogenic.vertical.strike and dip measured at site.original data.)

	B30	5	.BEDV.VERB.FADT.SDPM.ORG. (.bedding.volcanogenic.vertical.top of beds determined from facing structures.strike and dip measured at site.original data.)
	B31	6	.BEDV.OVTB.SDPM.ORG. (.bedding.volcanogenic.overturned.strike and dip measured at site.original data.)
	B32	7	.BEDV.OVTB.FADT.SDPM.ORG. (.bedding.volcanogenic.overturned.top of beds determined from facing structures.strike and dip measured at site.original data.)
	B33	8	.BEDV.INCB.FADU.SDPM.ORG. (.bedding.volcanogenic.inclined.facing unknown.strike and dip measured at site.original data.)
	B34	9	.BEDV.VERB.FADU.SDPM.ORG. (.bedding.volcanogenic.vertical.facing unknown.strike and dip measured at site.original data.)
	B35	10	.BEDV.OVTB.FADU.SDPM.ORG. (.bedding.volcanogenic.overturned.facing unknown.strike and dip measured at site.original data.)
	B36	11	.BEDVW.INCB.SDPM.ORG. (.bedding.volcanogenic.wavy or crinkled.inclined.strike and dip measured at site.original data.)
	B37	12	.BEDVW.VERB.SDPM. (.bedding.volcanogenic.wavy or crinkled.vertical.strike and dip measured at site.original data.)
	B38	13	.BEDVW.OVTB.SDPM.ORG. (.bedding.volcanogenic.wavy or crinkled.overturned.strike and dip measured at site.original data.)
	B39	2	.BEDV.INCB.SDPAI.ORG. (.bedding.volcanogenic.inclined.approximate.strike and dip direction indicated but not measured.original data.)
	B40	4	.BEDV.VERB.SDPAI.ORG. (.bedding.volcanogenic.vertical.approximate.strike and dip direction indicated but not measured.original data.)
	B41	6	.BEDV.OVTB.SDPAI.ORG. (.bedding.volcanogenic.overturned.approximate.strike and dip direction indicated but not measured.original data.)
	B42	14	.BEDV.INCB.SDPAE.ORG. (.bedding.volcanogenic.inclined.approximate.strike and dip estimated.original data.)
	B43	15	.BEDV.VERB.SDPAE.ORG. (.bedding.volcanogenic.vertical.approximate.strike and dip estimated.original data.)
	B44	16	.BEDV.INCB.SDPAEB.ORG. (.bedding.volcanogenic.inclined.approximate.strike and dip estimated from binocular observation.original data.)
	B45	17	.BEDV.VERB.SDPAEB.ORG. (.bedding.volcanogenic.vertical.approximate.strike and dip estimated from binocular observation.original data.)

	B46	18	.BEDV.INCB.SDPAEA.ORG. (.bedding.volcanogenic.inclined.approximate.strike and dip estimated from aerial photographs.original data.)
	B47	19	.BEDV.VERB.SDPAEA.ORG. (.bedding.volcanogenic.vertical.approximate.strike and dip estimated from aerial photographs.original data.)
	B48	20	.BEDV.INCB.CPD. (.bedding.volcanogenic.inclined.compiled data.)
	B49	21	.BEDV.VERB.CPD. (.bedding.volcanogenic.vertical.compiled data.)
	B50	22	.BEDV.OVTB.CPD. (.bedding.volcanogenic.overturned.compiled data.)

### MASSIVE-TEXTURE STRUCTURAL SYMBOLS (.MTX.)



#### .Foliation.igneous.massive texture. (.FOLI.MTX.)
















	MT1	30	.FOLI.MTX.SDPM.ORG. (.foliation.igneous.massive texture.measured at site.original data.)
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**FOLIATION STRUCTURAL SYMBOLS (.FOL)****.foliation.origin not determined. (.FOLN.)**

	FN1	40	.FOLN.HRZF.SDPM.ORG. (.foliation.origin not determined.horizontal.strike and dip measured at site.original data.)
	FN2	41	.FOLN.INCF.SDPM.ORG. (.foliation.origin not determined.inclined.strike and dip measured at site.original data.)
	FN3	42	.FOLN.VERF.SDPM.ORG. (.foliation.origin not determined.vertical.strike and dip measured at site.original data.)
	FN4	43	.FOLN.INCF.SDPAI.ORG. (.foliation.origin not determined.inclined.approximate.strike and dip direction indicated but not measured.original data.)
	FN5	44	.FOLN.VERF.SDPAI.ORG. (.foliation.origin not determined.vertical.approximate.strike and dip direction indicated but not measured.original data.)
	FN6	45	.FOLN.INCF.SDPAEB.ORG. (.foliation.origin not determined.inclined.approximate.strike and dip determined from binocular observation.original data.)
	FN7	46	.FOLN.VERF.SDPAEB.ORG. (.foliation.origin not determined.vertical.approximate.strike and dip determined from binocular observation.original data.)
	FN8	47	.FOLN.INCF.SDPAEA.ORG. (.foliation.origin not determined.inclined.approximate.strike and dip determined from aerial photographs.original data.)
	FN9	48	.FOLN.VERF.SDPAEA.ORG. (.foliation.origin not determined.vertical.approximate.strike and dip determined from aerial photographs.original data.)
	FN10	49	.FOLN.INCF.CPD. (.foliation.origin not determined.inclined.compiled data.)
	FN11	50	.FOLN.VERF.CPD. (.foliation.origin not determined.compiled data.)

**.foliation.igneous.flow origin. (.FOLI.FLW.)**

	FN12	51	.FOLI.FLW.HRZF.SDPM.ORG. (.foliation.igneous.flow origin.horizontal.strike and dip measured at site.original data.)
	FN13	52	.FOLI.FLW.INCF.SDPM.ORG. (.foliation.igneous.flow origin.inclined.strike and dip measured at site.original data.)

	FN14	53	.FOLI.FLW.VERF.SDPM.ORG. (.foliation.igneous.flow origin.vertical.strike and dip measured at site.original data.)
	FN15	54	.FOLI.FLW.INCF.SDPAI.ORG. (.foliation.igneous.flow origin.inclined.approximate.strike and dip direction indicated but not measured.original data.)
	FN16	55	.FOLI.FLW.VERF.SDPAI.ORG. (.foliation.igneous.flow origin.vertical.approximate.strike and dip direction indicated but not measured.original data.)
	FN17	56	.FOLI.FLW.INCF.SDPAEB.ORG. (.foliation.igneous.flow origin.inclined.approximate.strike and dip determined from binocular observation.original data.)
	FN18	57	.FOLI.FLW.VERF.SDPAEB.ORG. (.foliation.igneous.flow origin.vertical.approximate.strike and dip determined from binocular observation.original data.)
	FN19	58	.FOLI.FLW.INCF.SDPAEA.ORG. (.foliation.igneous.flow origin.inclined.approximate.strike and dip determined from aerial photographs.original data.)
	FN20	59	.FOLI.FLW.VERF.SDPAEA.ORG. (.foliation.igneous.flow origin.vertical.approximate.strike and dip determined from aerial photographs.original data.)
	FN21	60	.FOLI.FLW.INCF.CPD. (.foliation.igneous.flow origin.inclined.compiled data.)
	FN22	61	.FOLI.FLW.VERF.CPD. (.foliation.igneous.flow origin.vertical.compiled data.)
<b>.foliation.igneous.cumulate. (.FOLIC.)</b>			
	FN23	62	.FOLIC.HRZF.SDPM.ORG. (.foliation.igneous.cumulate.horizontal.strike and dip measured at site.original data.)
	FN24	63	.FOLIC.INCF.SDPM.ORG. (.foliation.igneous.cumulate.inclined.strike and dip measured at site.original data.)
	FN25	64	.FOLIC.INCF.FADT.SDPM.ORG. (.foliation.igneous.cumulate.inclined.top of layering determined from facing structures.strike and dip measured at site.original data.)
	FN26	65	.FOLIC.VERF.SDPM.ORG. (.foliation.igneous.cumulate.vertical.strike and dip measured at site.original data.)
	FN27	66	.FOLIC.VERF.FADT.SDPM.ORG. (.foliation.igneous.cumulate.vertical.top of layering determined from facing structures.strike and dip measured at site.original data.)
	FN28	67	.FOLIC.INCF.CPD. (.foliation.igneous.cumulate.inclined.compiled data.)



FN29 68 .FOLIC.VERF.CPD. (.foliation.igneous.cumulate.vertical.compiled data.)

**.foliation.strain dominated. (.FOLS.)**



FN30 69 .FOLS.HRZF.SDPM.ORG. (.foliation.strain dominated.horizontal.strike and dip measured at site.original data.)



FN31 70 .FOLS.INCF.SDPM.ORG. (.foliation.strain dominated.inclined.strike and dip measured at site.original data.)



FN32 71 .FOLS.VERF.SDPM.ORG. (.foliation.strain dominated.vertical.strike and dip measured at site. .original data.)



FN33 72 .FOLS.INCF.SDPAI.ORG. (.foliation.strain dominated.inclined.approximate.strike and dip direction indicated but not measured.original data.)



FN34 73 .FOLS.VERF.SDPAI.ORG. (.foliation.strain dominated.vertical.approximate.strike and dip direction indicated but not measured.original data.)



FN35 74 .FOLS.INCF.SDPAEB.ORG. (.foliation.strain dominated.inclined.approximate.strike and dip determined from binocular observation.original data.)



FN36 75 .FOLS.VERF.SDPAEB.ORG. (.foliation.strain dominated.vertical.approximate.strike and dip determined from binocular observation.original data.)



FN37 76 .FOLS.INCF.SDPAEA.ORG. (.foliation.strain dominated.inclined.approximate.strike and dip determined from aerial photographs.original data.)



FN38 77 .FOLS.VERF.SDPAEA.ORG. (.foliation.strain dominated.vertical.approximate.strike and dip determined from aerial photographs.original data.)



FN39 78 .FOLS.INCF.CPD. (.foliation.strain dominated.inclined.compiled data.)



FN40 79 .FOLS.VERF.CPD. (.foliation.strain dominated.vertical.compiled data.)

**.foliation.metamorphic. (.FOLM.)**












FN41 80 .FOLM.HRZF.SDPM.ORG. (.foliation.metamorphic.horizontal.strike and dip measured at site.original data.)













FN42 81 .FOLM.INCF.SDPM.ORG. (.foliation.metamorphic.inclined.strike and dip measured at site.original data.)











	FN43	82	.FOLM.VERF.SDPM.ORG. (.foliation.metamorphic.vertical.strike and dip measured at site.original data.)
	FN44	83	.FOLM.INCF.SDPAI.ORG. (.foliation.metamorphic.inclined.approximate.strike and dip direction indicated but not measured.original data.)
	FN45	84	.FOLM.VERF.SDPAI.ORG. (.foliation.metamorphic.vertical.approximate.strike and dip direction indicated but not measured.original data.)
	FN46	85	.FOLM.INCF.SDPAEB.ORG. (.foliation.metamorphic.inclined.approximate.strike and dip determined from binocular observation.original data.)
	FN47	86	.FOLM.VERF.SDPAEB.ORG. (.foliation.metamorphic.vertical.approximate.strike and dip determined from binocular observation.original data.)
	FN48	87	.FOLM.INCF.SDPAEA.ORG. (.foliation.metamorphic.inclined.approximate.strike and dip determined from aerial photographs.original data.)
	FN49	88	.FOLM.VERF.SDPAEA.ORG. (.foliation.metamorphic.vertical.approximate.strike and dip determined from aerial photographs.original data.)
	FN50	89	.FOLM.INCF.CPD. (.foliation.metamorphic.inclined.compiled data.)
	FN51	90	.FOLM.VERF.CPD. (.foliation.metamorphic.vertical.compiled data.)

**.foliation.metamorphic.undulatory. (.FOLMU.)**







	FN52	91	.FOLMU.HRZF.SDPM.ORG. (.foliation.metamorphic.undulatory.horizontal.strike and dip measured at site.original data.)
	FN53	92	.FOLMU.INCF.SDPM.ORG. (.foliation.metamorphic.undulatory.inclined.strike and dip measured at site.original data.)
	FN54	93	.FOLMU.VERF.SDPM.ORG. (.foliation.metamorphic.undulatory.vertical.strike and dip measured at site.original data.)
	FN55	94	.FOLMU.INCF.SDPAI.ORG. (.foliation.metamorphic.undulatory.inclined.approximate.strike and dip direction indicated but not measured.original data.)
	FN56	95	.FOLMU.VERF.SDPAI.ORG. (.foliation.metamorphic.undulatory.vertical.approximate.strike and dip direction indicated but not measured.original data.)
	FN57	94	.FOLMU.INCF.SDPAEB.ORG. (.foliation.metamorphic.undulatory.inclined.approximate.strike and dip determined from binocular observation.original data.)
	FN58	95	.FOLMU.VERF.SDPAEB.ORG. (.foliation.metamorphic.undulatory.vertical.approximate.strike and dip determined from binocular observation.original data.)

	FN59	94	.FOLMU.INCF.SDPAEA.ORG. (.foliation.metamorphic.undulatory.inclined.approximate.strike and dip determined from aerial photographs.original data.)
	FN60	95	.FOLMU.VERF.SDPAEA.ORG. (.foliation.metamorphic.undulatory.vertical.approximate.strike and dip determined from aerial photographs.original data.)
	FN61	94	.FOLMU.INCF.CPD. (.foliation.metamorphic.undulatory.inclined.compiled data.)
	FN62	95	.FOLMU.VERF.CPD. (.foliation.metamorphic.undulatory.vertical.compiled data.)

**JOINT STRUCTURAL SYMBOLS (.JNT)****JOINTS DEVELOPED IN SEDIMENTARY ROCK (.JNTS)**

	J1	105	.JNTS.INCJ.SDPM.ORG. (.joint.sedimentary.inclined.strike and dip measured at site.original data.)
	J2	106	.JNTS.VERJ.SDPM.ORG. (.joint.sedimentary.vertical.strike and dip measured at site.original data.)
	J3	105	.JNTS.INCJ.SDPAEB.ORG. (.joint.sedimentary.inclined.approximate.strike and dip estimated from binocular observation.original data.)
	J4	106	.JNTS.VERJ.SDPAEB.ORG. (.joint.sedimentary.vertical.approximate.strike and dip estimated from binocular observation.original data.)
	J5	105	.JNTS.INCJ.SDPAEA.ORG. (.joint.sedimentary.inclined.approximate.strike and dip estimated from aerial photographs.original data.)
	J6	106	.JNTS.VERJ.SDPAEA.ORG. (.joint.sedimentary.vertical.approximate.strike and dip estimated from aerial photographs.original data.)
	J7	107	.JNTS.INCJ.CPD. (.joint.sedimentary.inclined.compiled data.)
	J8	108	.JNTS.VERJ.CPD. (.joint.sedimentary.vertical.compiled data.)




**JOINTS DEVELOPED IN IGNEOUS ROCK (.JNTI)**

	J9	109	.JNTIP.INCJ.SDPM.ORG. (.joint.igneous.plutonic.inclined.strike and dip measured at site.original data.)
	J10	110	.JNTIP.VERJ.SDPM.ORG. (.joint.igneous.plutonic.vertical.strike and dip measured at site.original data.)
	J11	109	.JNTIP.INCJ.SDPAEB.ORG. (.joint.igneous.plutonic.inclined.approximate.strike and dip estimated from binocular observation.original data.)
	J12	110	.JNTIP.VERJ.SDPAEB.ORG. (.joint.igneous.plutonic.vertical.approximate.strike and dip estimated from binocular observation.original data.)
	J13	109	.JNTIP.INCJ.SDPAEA.ORG. (.joint.igneous.plutonic.inclined.approximate.strike and dip estimated from aerial photographs.original data.)
	J14	110	.JNTIP.VERJ.SDPAEA.ORG. (.joint.igneous.plutonic.vertical.approximate.strike and dip estimated from aerial photographs.original data.)














	J15	111	.JNTIP.INCJ.CPD. (.joint.igneous.plutonic.inclined.compiled data.)
	J16	112	.JNTIP.VERJ.CPD. (.joint.igneous.plutonic.vertical.compiled data.)
	J17	109	.JNTIV.INCJ.SDPM.ORG. (.joint.igneous.volcanic.inclined.strike and dip measured at site.original data.)
	J18	110	.JNTIV.VERJ.SDPM.ORG. (.joint.igneous.volcanic.vertical.strike and dip measured at site.original data.)
	J19	109	.JNTIV.INCJ.SDPAEB.ORG. (.joint.igneous.volcanic.inclined.approximate.strike and dip estimated from binocular observation.original data.)
	J20	110	.JNTIV.VERJ.SDPAEB.ORG. (.joint.igneous.volcanic.vertical.approximate.strike and dip estimated from binocular observation.original data.)
	J21	109	.JNTIV.INCJ.SDPAEA.ORG. (.joint.igneous.volcanic.inclined.approximate.strike and dip estimated from aerial photographs.original data.)
	J22	110	.JNTIV.VERJ.SDPAEA.ORG. (.joint.igneous.volcanic.vertical.approximate.strike and dip estimated from aerial photographs.original data.)
	J23	111	.JNTIV.INCJ.CPD. (.joint.igneous.volcanic.inclined.compiled data.)
	J24	112	.JNTIV.VERJ.CPD. (.joint.igneous.volcanic.vertical.compiled data.)






**CLEAVAGE STRUCTURAL SYMBOLS (.CLV)**

	CLV1	113	.CLVO.HRZC.SDPM.ORG. (.cleavage.one cleavage.horizontal.strike and dip measured at site.original data.)
	CLV2	114	.CLVO.INCC.SDPM.ORG. (.cleavage.one cleavage.inclined.strike and dip measured at site.original data.)
	CLV3	115	.CLVO.INCC.CPD. (.cleavage.one cleavage.inclined.compiled data.)
	CLV4	116	.CLVO.VERC.SDPM.ORG. (.cleavage.one cleavage.vertical.strike and dip measured at site.original data.)
	CLV5	117	.CLVO.VERC.CPD. (.cleavage.one cleavage.vertical.compiled data.)






	CLV6	118	.CLVT.HRZC.SDPM.ORG. (.cleavage.two cleavages.horizontal.strike and dip measured at site.original data.)
	CLV7	119	.CLVT.INCC.SDPM.ORG. (.cleavage.two cleavages.inclined.strike and dip measured at site.original data.)
	CLV8	120	.CLVT.VERC.SDPM.ORG. (.cleavage.two cleavages.vertical.strike and dip measured at site.original data.)

**LINEATION STRUCTURAL SYMBOLS (.LIN)**



	L1	130	.LINN.ORG. (.lineation.origin not determined.original data.)
LINEATIONS RELATED TO PALEOCURRENTS IN SEDIMENTARY ROCKS			
	L2	131	.LINS.PALU.ORG. (.lineation.sedimentary.paleocurrent direction.unidirectional.original data.)
	L3	132	.LINS.PALB.ORG. (.lineation.sedimentary.paleocurrent direction.bidirectional.original data.)
LINEATIONS ON FAULT SURFACES			
	L4	133	.LINFU.ORG. (.lineation.fault-slip direction.unidirectional.original data.)
	L5	134	.LINFB.ORG. (.lineation.fault-slip direction.bidirectional.original data.)
LINEATIONS RELATED TO FLOW IN IGNEOUS ROCKS			
	L6	135	.LINIF.ORG. (.lineation.igneous.flow related.original data.)
	L7	136	.LINIF.HRZLI.ORG. (.lineation.igneous.horizontal in plane of inclined foliation.original data.)
	L8	137	.LINIF.HRZLV.ORG. (.lineation.igneous.horizontal in plane of vertical foliation.original data.)
	L9	138	.LINI.AMGI.ORG. (.lineation.igneous.aligned mineral grains.original data.)
HORIZONTAL LINEATIONS IN METAMORPHIC ROCKS			
	L10	139	.LINM.HRZLI.ORG. (.lineation.metamorphic.horizontal in plane of inclined foliation.original data.)
	L11	140	.LINM.HRZLV.ORG. (.lineation.metamorphic.horizontal in plane of vertical foliation.original data.)
LINEATIONS IN HIGH-STRAIN ROCKS			
	L12	141	.LINH.HRZLI.ORG. (.lineation.high-strain rock.horizontal in plane of inclined foliation.original data.)
	L13	142	.LINH.HRZLV.ORG. (.lineation.high-strain rock.horizontal in plane of vertical foliation.original data.)

	L14	143	.LINH.CSTH.ORG. (.lineation.high-strain rock.crushed and streaked mineral grains.original data.)
	L15	144	.LINH.RODH.ORG. (.lineation.high-strain rock.rodging.original data.)
	L16	145	.LINH.CSRH.ORG. (.lineation.high-strain rock.crushed and streaked mineral grains together with rodging.original data.)
	L17	146	.LINH.AMGH.ORG. (.lineation.high-strain rock.aligned mineral grains.original data.)
	L18	147	.LINH.CSAH.ORG. (.lineation.high-strain rock.crushed and streaked mineral grains together with aligned mineral grains.metamorphic.original data.)



## LINEATIONS IN METAMORPHIC ROCKS

	L19	143	.LINM.CSTM.ORG. (.lineation.metamorphic.crushed and streaked mineral grains.original data.)
	L20	144	.LINM.RODM.ORG. (.lineation.metamorphic.rodging.original data.)
	L21	145	.LINM.CSRM.ORG. (.lineation.metamorphic.crushed and streaked mineral grains together with rodging.original data.)
	L22	146	.LINM.AMGM.ORG. (.lineation.metamorphic.aligned mineral grains.original data.)
	L23	147	.LINM.CSAM.ORG. (.lineation.metamorphic.crushed and streaked mineral grains together with aligned mineral grains.metamorphic.original data.)

## LINEATIONS IN SEDIMENTARY ROCKS






	L24	144	.LINS.RODS.ORG. (.lineation.sedimentary.rodging.original data.)
	L25	148	.LINS.IBC.ORG. (.lineation.sedimentary.intersection of bedding and cleavage.original data.)

## LINEATIONS IN METAMORPHIC ROCKS

	L26	149	.LINM.IFC.ORG. (.lineation.metamorphic.intersection of foliation and cleavage.original data.)
	L27	150	.LINM.BDG.ORG. (.lineation.boudinage.original data.)

## MINOR-FOLD LINEATIONS IN IGNEOUS ROCKS



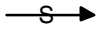








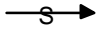


	L28	151	.LINAL.GND.ORG. (.lineation.minor fold axis.igneous.fold geometry not determined.original data.)
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









	L29	152	.LINAI.SFL.ORG. (.lineation.minor fold axis.igneous.synformal.original data.)
	L30	153	.LINAI.AFL.ORG. (.lineation.minor fold axis.igneous.antiformal.original data.)
	L31	154	.LINAI.ROTD.ORG. (.lineation.minor fold axis.igneous.dextral rotation.original data.)
	L32	155	.LINAI.ROTS.ORG. (.lineation.minor fold axis.igneous.sinistral rotation.original data.)
	L33	156	.LINAI.ROTN.ORG. (.lineation.minor fold axis.igneous.rotation sense not determined.original data.)
	L34	157	.LINAI.KKF.ORG. (.lineation.minor fold axis.igneous.kink band fold.original data.)
	L35	158	.LINAI.RFHA.ORG. (.lineation.minor fold axis.igneous.rootless fold hinge.antiformal.original data.)
	L36	159	.LINAI.RFHS.ORG. (.lineation.minor fold axis.igneous.rootless fold hinge.synformal.original data.)

#### MINOR-FOLD LINEATIONS IN METAMORPHIC ROCKS





	L37	151	.LINAM.GND.ORG. (.lineation.minor fold axis.metamorphic.fold geometry not determined.original data.)
	L38	152	.LINAM.SFL.ORG. (.lineation.minor fold axis.metamorphic.synformal.original data.)
	L39	153	.LINAM.AFL.ORG. (.lineation.minor fold axis.metamorphic.antiformal.original data.)
	L40	154	.LINAM.ROTD.ORG. (.lineation.minor fold axis.metamorphic.dextral rotation.original data.)
	L41	155	.LINAM.ROTS.ORG. (.lineation.minor fold axis.metamorphic.sinistral rotation.original data.)
	L42	156	.LINAM.ROTN.ORG. (.lineation.minor fold axis.metamorphic.rotation sense not determined.original data.)
	L43	157	.LINAM.KKF.ORG. (.lineation.minor fold axis.metamorphic.kink band fold.original data.)








	L44	158	.LINAM.RFHA.ORG. (.lineation.minor fold axis.metamorphic.rootless fold hinge.antiformal.original data.)
	L45	159	.LINAM.RFHS.ORG. (.lineation.minor fold axis.metamorphic.rootless fold hinge.synformal.original data.)
MINOR-FOLD LINEATIONS IN SEDIMENTARY ROCKS			
	L46	151	.LINAS.GND.ORG. (.lineation.minor fold axis.sedimentary.fold geometry not determined.original data.)
	L47	152	.LINAS.SFL.ORG. (.lineation.minor fold axis.sedimentary.synformal.original data.)
	L48	153	.LINAS.AFL.ORG. (.lineation.minor fold axis.sedimentary.antiformal.original data.)
	L49	154	.LINAS.ROTD.ORG. (.lineation.minor fold axis.sedimentary.dextral rotation.original data.)
	L50	155	.LINAS.ROTS.ORG. (.lineation.minor fold axis.sedimentary.sinistral rotation.original data.)
	L51	156	.LINAS.ROTN.ORG. (.lineation.minor fold axis.sedimentary.rotation sense not determined.original data.)
	L52	157	.LINAS.KKF.ORG. (.lineation.minor fold axis.sedimentary.kink band fold.original data.)
	L53	158	.LINAS.RFHA.ORG. (.lineation.minor fold axis.sedimentary.rootless fold hinge.antiformal.original data.)
	L54	159	.LINAS.RFHS.ORG. (.lineation.minor fold axis.sedimentary.rootless fold hinge.synformal.original data.)
MINOR-FOLD LINEATIONS IN HIGH-STRAIN ROCKS			
	L55	151	.LINAH.GND.ORG. (.lineation.minor fold axis.high-strain rock.fold geometry not determined.original data.)
	L56	152	.LINAH.SFL.ORG. (.lineation.minor fold axis.high-strain rock.synformal.original data.)
	L57	153	.LINAH.AFL.ORG. (.lineation.minor fold axis.high-strain rock.antiformal.original data.)

	L58	154	.LINAH.ROTD.ORG. (.lineation.minor fold axis.high-strain rock.dextral rotation.original data.)
	L59	155	.LINAH.ROTS.ORG. (.lineation.minor fold axis.high-strain rock.sinistral rotation.original data.)
	L60	156	.LINAH.ROTN.ORG. (.lineation.minor fold axis.high-strain rock.rotation sense not determined.original data.)
	L61	157	.LINAH.KKF.ORG. (.lineation.minor fold axis.high-strain rock.kink band fold.original data.)
	L62	158	.LINAH.RFHA.ORG. (.lineation.minor fold axis.high-strain rock.rootless fold hinge.antiformal.original data.)
	L63	159	.LINAH.RFHS.ORG. (.lineation.minor fold axis.high-strain rock.rootless fold hinge.synformal.original data.)
MISCELLANEOUS LINEATIONS			
	L64	160	.LIN.TLNP.ORG. (.lineation.two parallel lineations.metamorphic.original data.)
	L65	161	.LIN.LINT.ORG. (.lineation.two lineations normal to each other.metamorphic.original data.)
	L66	162	.LIN.ORG. (.lineation.original data.)
	L67	163	.LIN.ORG. (.lineation.original data.)




**POINT ATTRIBUTES FOR GEOLOGIC CONTACTS (.PAC.)**

	CC1	180	.PACD.ORG. (.geologic contact attribute.dip direction.original data.)
	CC2	181	.PACOK.ORG. (.geologic contact attribute.clearly observable.knife-edge.original data.)
	CC3	182	.PACOT.ORG. (.geologic contact attribute.clearly observable.transitional over 1 to 10 meters.original data.)
	CC4	183	.PACOG.ORG. (.geologic contact attribute.clearly observable.gradational over 1 to 10 meters.original data.)




**POINT ATTRIBUTES FOR FAULTS (.PAF.)**

	FC1	190	.PAFB. (.fault attribute.bar and ball on downdropped block.)
	FC2	191	.PAFSR. (.fault attribute.strike slip arrows.right lateral.)
	FC3	192	.PAFSL. (.fault attribute.strike slip arrows.left lateral.)
	FC4	193	.PAFD. (.fault attribute.fault dip direction.original data.)
	FC5	194	.PAFA. (.fault attribute.annotation balloon.)




**POINT ATTRIBUTES FOR FOLDS (.PAO.)****Antiform (.PAOAF.)**

	FAC1	200	.PAOAF.UPRA. (.fold attribute.antiform.upright axial plane.)
	FAC2	201	.PAOAF.OVTA. (.fold attribute.antiform.overturned axial plane.)
	FAC3	202	.PAOAF.OVTA. (.fold attribute.antiform.overturned axial plane.)




**Anticline (.PAOAC.)**

	FAC4	203	.PAOAC.UPRA. (.fold attribute.antiform.upright axial plane.)
	FAC5	204	.PAOAC.OVTA. (.fold attribute.antiform.overturned axial plane.)
	FAC6	205	.PAOAC.OVTA. (.fold attribute.antiform.overturned axial plane.)




**Synform (.PAOSF.)**

	FAC7	206	.PAOSF.UPRA. (.fold attribute.synform.upright axial plane.)
	FAC8	207	.PAOSF.OVTA. (.fold attribute.synform.overturned axial plane.)
	FAC9	208	.PAOSF.OVTA. (.fold attribute.synform.overturned axial plane.)







**Syncline (.PAOSC.)**


	FAC10	209	.PAOSC.UPRA. (.fold attribute.syncline.upright axial plane.)
	FAC11	210	.PAOSC.OVTA. (.fold attribute.syncline.overturned axial plane.)
	FAC12	211	.PAOSC.OVTA. (.fold attribute.syncline.overturned axial plane.)

**Refolded fold (.PAOR.)**

	FAC13	212	.PAORN. (.fold attribute.refolded fold.fold form not determined.)
	FAC14	213	.PAORD.AFS. (.fold attribute.refolded fold.fold form determined.antiformal syncline.)
	FAC15	214	.PAORD.SFA. (.fold attribute.refolded fold.fold form determined.synformal anticline.)

**Fold-hinge plunge (arrowhead ornament)**

	FAC16	215	.PAOAF.PLD. (.fold attribute.antiform.plunge direction.)
	FAC17	216	.PAOAC.PLD. (.fold attribute.anticline.plunge direction.)
	FAC18	215	.PAOSF.PLD. (.fold attribute.synform.plunge direction.)
	FAC19	216	.PAOSC.PLD. (.fold attribute.syncline.plunge direction.)
	FAC20	215	.PAORN.PLD. (.fold attribute.refolded fold.fold form not determined.plunge direction.)
	FAC21	215	.PAORD.AFS.PLD. (.fold attribute.refolded fold.fold form determined.antiformal syncline.plunge direction.)

	FAC22	216	.PAORD.SFA.PLD. (.fold attribute.refolded fold.fold form determined.synformal anticline.plunge direction.)
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**SYMBOLS FOR OBSERVATION STATION (.OST)**

○	OS1	230	.OSTG.ORG. (.observation station.general observation.original data.)
◉	OS2	231	.OSTL.ORG. (.observation station.lithologic description.original data.)
△	OS3	232	.OSTSE.ORG. (.observation station.soil profile examined.original data.)
▲	OS4	233	.OSTSD.ORG. (.observation station.soil profile described.original data.)
◇	OS5	234	.OSTFC.ORG. (.observation station.fossil collection.original data.)
◈	OS6	235	.OSTFD.ORG. (.observation station.fossil description.original data.)
▣	OS7	236	.OSTFO.ORG. (.observation station.fossils observed.original data.)
□	OS8	237	.OSTM.ORG. (.observation station.modal mineralogy determination.original data.)
⊙	OS9	238	.OSTB.ORG. (.observation station.subsurface boring site.original data.)
⊕	OS10	239	.OSTA.ORG. (.observation station.annotation site.original data.)
△	OS11	240	.OSTI.ORG. (.observation station.isotopic-age determination.original data.)
•	OS12	241	.OSTP.ORG. (.observation station.paleomagnetic determination.original data.)
	OS13	242	.OSTC.ORG. (.observation station.geochemistry determination.original data.)
	OS14	243	.OSTU.ORG. (.observation station.magnetic susceptibility determination.original data.)
	OS15	244	.OSTV.ORG. (.observation station.gravity determination.original data.)

## **GEOLOGIC-POINT ATTRIBUTES (alphabetic listing by major topic) Version 1.0**

### **U.S. Geological Survey, Southern California Areal Mapping Project**

#### **POINTS OF ALL TYPES**

Bedding attitude=.BED.  
Cleavage attitude=.CLV.  
Fault attribute=.PAF.  
Fold attribute=.PAO.  
Foliation attitude=.FOL  
Geologic contact attribute=.PAC.  
Joint attitude=.JNT.  
Lineation=.LIN  
Massive texture in igneous rock=.MTX.  
Observation station=.OST

#### **BEDDING STRUCTURAL SYMBOLS (.BED.)**

Bedding=.BED  
    bedding in sedimentary rock=.BEDS.  
        wavy or crinkled bedding=.BEDSW.  
    bedding in volcanogenic sedimentary rock=.BEDV.  
        wavy or crinkled bedding=.BEDVW.

##### **Orientation of dip**

horizontal=.HRZB.  
inclined=.INCB.  
overturned=.OVTB.  
vertical=.VERB.

##### **Data integrity**

strike and dip measured at site=.SDPM.  
    facing direction known (top of beds determined from facing structures)=.FADT.  
    facing direction unknown=.FADU.  
strike and dip approximate=.SDPA.  
    strike and dip direction indicated but not measured=.SDPAI.  
    strike and dip estimated=.SDPAE.  
        strike and dip estimated from binocular observation=.SDPAEB.  
        strike and dip estimated from aerial photographs=.SDPAEA.

##### **Source of data**

data compiled from non-USGS sources=.CPD.  
original USGS data collected by map authors=.ORG.

#### **CLEAVAGE STRUCTURAL SYMBOLS (.CLV.)**

##### **Cleavage type**

one cleavage=.CLVO.  
two cleavages=.CLVT.

##### **Orientation of dip**

horizontal=.HRZC.  
inclined=.INCC.  
vertical=.VERC.





Data integrity

- strike and dip measured at site=.SDPM.
- strike and dip approximate=.SDPA.
  - strike and dip direction indicated but not measured=.SDPAI.
  - strike and dip estimated=.SDPAE.
    - strike and dip estimated from binocular observation=.SDPAEB.
    - strike and dip estimated from aerial photographs=.SDPAEA.

Source of data

- data compiled from non-USGS sources=.CPD.
- original USGS data collected by map authors=.ORG.

**CONTACT-ATTRIBUTE SYMBOLS (.PAC.)**

Contact-attribute type

- dip direction=.PACD.
- contact clearly observable=.PACO.
  - knife-edge=.PACOK.
  - transitional over 1 to 10 meters=.PACOT.
  - gradational over 1 to 10 meters=.PACOG.

Source of data

- data compiled from non-USGS sources=.CPD.
- original USGS data collected by map authors=.ORG.

**FAULT-ATTRIBUTE SYMBOLS (.PAF.)**

Fault-attribute type=.PAF

- annotation balloon=.PAFA.
- bar and ball on down-dropped fault block=.PAFB.
- fault-dip direction=.PAFD.
- strike-slip arrows=.PAFS.
  - left lateral=.PAFSL.
  - right lateral=.PAFSR.

Source of data

- data compiled from non-USGS sources=.CPD.
- original USGS data collected by map authors=.ORG.

**FOLD-ATTRIBUTE SYMBOLS (.PAO)**

Fold form not determined

- antiform=.PAOAF.
  - upright axial plane=.UPRA.
  - overturned axial plane=.OVTA.
- synform=.PAOSF.
  - upright axial plane=.UPRA.
  - overturned axial plane=.OVTA.

Fold form determined

- anticline=.PAOAC.
  - upright axial plane=.UPRA.
  - overturned axial plane=.OVTA.
- syncline=.PAOSC.

upright axial plane=.UPRA.  
 overturned axial plane=.OVTA.

Refolded fold=.PAOR.

fold form not determined=.PAORN.

fold form determined=.PAORD.

antiformal syncline=.AFS.  
 upright axial plane=.UPRA.  
 overturned axial plane=.OVTA.  
 synformal anticline=.SFA.  
 upright axial plane=.UPRA.  
 overturned axial plane=.OVTA.

Fold-hinge plunge direction=.PLD.

Source of data

data compiled from non-USGS sources=.CPD.  
 original USGS data collected by map authors=.ORG.

## FOLIATION STRUCTURAL SYMBOLS (.FOL)

Foliation, igneous=.FOLI.  
 cumulate foliation=.FOLIC.  
 flow foliation=.FLW.  
 plutonic foliation=.FOLIP.  
 oriented mineral grains=.FOLIPM.  
 oriented schlieren=.FOLIPS.  
 oriented xenoliths=.FOLIPX.  
 volcanic foliation=.FOLIV.  
 oriented lapilli=.FOLIVL.

Foliation, metamorphic=.FOLM.  
 undulatory foliation=.FOLMU.  
 crenulated foliation=.FOLMUC.  
 gneissosity=.FOLMG.  
 crinkled foliation=.FOLMUK.  
 schistosity=.FOLMS.  
 wavy foliation=.FOLMUW.

Foliation, strain dominated=.FOLD.  
 cataclastic foliation=.SDOC.  
 mylonitic foliation=.SDOM.

Foliation, origin not determined=.FOLN.  
 gneissose foliation, origin not determined=.FOLNG.  
 mineral foliation, origin not determined=.FOLNM.

Orientation of dip

horizontal=.HRZF.  
 inclined=.INCF.  
 overturned=.OVTF.  
 vertical=.VERF.

Data integrity

strike and dip measured at site=.SDPM.  
 facing known (top of beds determined from facing structures)=.FADT.

facing unknown=.FADU.  
 strike and dip approximate=.SDPA.  
 strike and dip direction indicated but not measured=.SDPAI.  
 strike and dip estimated=.SDPAE.  
 strike and dip estimated from binocular observation=.SDPAEB.  
 strike and dip estimated from aerial photographs=.SDPAEA.

#### Source of data

data compiled from non-USGS sources=.CPD.  
 original USGS data collected by map authors=.ORG.

### GEOLOGIC AGE CLASSIFICATION (chronologic listing, youngest to oldest)

Age unknown=.AGU.

Cenozoic=.CZO.

Quaternary=.CZOQ.

Holocene=.CZOQH.  
 Modern=.CZOQHD.  
 Holocene, late=.CZOQHL.  
 Holocene, middle=.CZOQHM.  
 Holocene, early=.CZOQHE.  
 Pleistocene=.CZOQP.  
 Pleistocene, late=.CZOQPL.  
 Pleistocene, middle=.CZOQPM.  
 Pleistocene, early=.CZOQPE.

Tertiary=.TER.

Neogene=-NGN-

Pliocene=.CZOTP.  
 Pliocene, late=.CZOTPL.  
 Pliocene, early=.CZOTPE.  
 Miocene=.CZOTM.  
 Miocene, late=.CZOTML.  
 Miocene, middle=.CZOTMM.  
 Miocene, early=.CZOTME.  
 Oligocene=.CZOTO.  
 Oligocene, late=.CZOTOL.  
 Oligocene, early=.CZOTOE.  
 Eocene=.CZOTE.  
 Eocene, late=.CZOTEL.  
 Eocene, middle=.CZOTEM.  
 Eocene, early=.CZOTEE.  
 Paleocene=.CZOTA.  
 Paleocene, late=.CZOTAL.  
 Paleocene, early=.CZOTAE.

Paleogene=-PGN-

Mesozoic=.MZO.

Cretaceous=.MZOK.  
 Cretaceous, late=.MZOKL.  
 Cretaceous, early=.MZOKE.  
 Jurassic=.MZOJ.  
 Jurassic, late=.MZOJL.  
 Jurassic, early=.MZOJE.  
 Triassic=.MZOT.  
 Triassic, late=.MZOTL.  
 Triassic, early=.MZOTE.

Paleozoic=.PZO.

Permian=.PZOR.

Permian, late=.PZORL.

Permian, early=.PZORE.

Late Paleozoic=-PZOL-

Pennsylvanian=.PZOP.

Pennsylvanian, late=.PZOPL.

Pennsylvanian, early=.PZOPE.

Mississippian=.PZOM.

Mississippian, late=.PZOML.

Mississippian, early=.MISE

Devonian=.PZOD.

Devonian, late=.PZODL.

Devonian, early=.PZODE.

Middle Paleozoic=-PZOI-

Silurian=.PZOS.

Silurian, late=.PZOSL.

Silurian, early=.PZOSE.

Ordovician=.PZOO.

Ordovician, late=.PZOOL.

Ordovician, early=.PZOOE.

Early Paleozoic=-PZOE-

Cambrian=.PZOC.

Cambrian, late=.PZOCL.

Cambrian, early=.PZOCE.

Precambrian=.PRC.

Archean=.PRCA.

Archean, late=.PRCAL.

Archean, middle=.PRCAM.

Archean, early=.PRCAE.

Proterozoic=.PRCP.

Proterozoic, late=.PRCPL.

Proterozoic, middle=.PRCPM.

Proterozoic, early=.PRCPE.

## GEOLOGIC AGE CLASSIFICATION (alphabetic listing)

age unknown=.AGU.

Archean=.PRCA.

Archean, early=.PRCAE.

Archean, late=.PRCAL.

Archean, middle=.PRCAM.

Cambrian=.PZOC.

Cambrian, early=.PZOCE.

Cambrian, late=.PZOCL.

Cenozoic=.CZO.

Cretaceous=.MZOK.

Cretaceous, early=.MZOKE.

Cretaceous, late=.MZOKL.

Devonian=.PZOD.

Devonian, early=.PZODE.

Devonian, late=.PZODL.

Eocene=.CZOTE.

Eocene, early=.CZOTEE.

Eocene, middle=.CZOTEM.

Eocene, late=.CZOTEL.

Holocene=.CZOQH.

Holocene, early=.CZOQHE.

Holocene, late=.CZOQHL.

Holocene, middle=.CZOQHM.

Jurassic=.MZOJ.

Jurassic, early=.MZOJE.

Jurassic, late=.MZOJL.  
 Mesozoic=.MZO.  
 Miocene=.CZOTM.  
 Miocene, early=.CZOTME.  
 Miocene, late=.CZOTML.  
 Miocene, middle=.CZOTMM.  
 Mississippian=.PZOM.  
 Mississippian, early=.PZOME.  
 Mississippian, late=.PZOML.  
 Modern=.CZOQHD.  
 Neogene=-NGN-  
 Oligocene=.CZOTO.  
 Oligocene, early=.CZOTOE.  
 Oligocene, late=.CZOTOL.  
 Ordovician=.PZOO.  
 Ordovician, early=.PZOOE.  
 Ordovician, late=.PZOOL.  
 Paleocene=.CZOTA.  
 Paleocene, early=.CZOTAE.  
 Paleocene, late=.CZOTAL.  
 Paleogene=-PGN-  
 Paleozoic=.PZO.  
 Paleozoic, early=-PZOE-  
 Paleozoic, late=-PZOL-  
 Paleozoic, middle=-PZOI-  
 Pennsylvanian=.PZOP.  
 Pennsylvanian, early=.PZOPE.  
 Pennsylvanian, late=.PZOPL.  
 Permian=.PZOR.  
 Permian, early=.PZORE.  
 Permian, late=.PZORL.  
 Pleistocene=.CZOQP.  
 Pleistocene, early=.CZOQPE.  
 Pleistocene, late=.CZOQPL.  
 Pleistocene, middle=.CZOQPM.  
 Pliocene=.CZOTP.  
 Pliocene, early=.CZOTPE.  
 Pliocene, late=.CZOTPL.  
 Precambrian=.PRC.  
 Proterozoic=.PRCP.  
 Proterozoic, early=.PRCPE.  
 Proterozoic, late=.PRCPL.  
 Proterozoic, middle=.PRCPM.  
 Quaternary=.CZOQ.  
 Silurian=.PZOS.  
 Silurian, early=.PZOSE.  
 Silurian, late=.PZOSL.  
 Tertiary=.TER.  
 Triassic=.MZOT.  
 Triassic, early=.MZOTE.  
 Triassic, late=.MZOTL.

#### **GEOLOGIC AGE CRITERIA (basis and confidence of unit-age assignment)**

Fossil age=.FSL.  
     age is certain=.FSLC.  
     age is uncertain=.FSLU.  
  
 Geomorphic development=.GMD.  
     age is certain=.GMDC.  
     age is uncertain=.GMDU.

Intrusive relations=.INR.  
     age is certain=.INRC.  
     age is uncertain=.INRU.

Isotopic age=.IAG.  
     age is certain=.IAGC.  
     age is uncertain=.IAGU.

Paleomagnetism=.PMG.  
     age is certain=.PMGC.  
     age is uncertain=.PMGU.

Pedogenic-soil development=.SOD.  
     age is certain=.SODC.  
     age is uncertain=.SODU.

Regional correlation=.RCO.  
     age is certain=.RCOC.  
     age is uncertain=.RCOU.

Stratigraphic relations=.SRL.  
     age is certain=.SRLC.  
     age is uncertain=.SRLU.

Tephrochronology=.TEP.  
     age is certain=.TEPC.  
     age is uncertain=.TEPU.

#### **JOINT STRUCTURAL SYMBOLS (.JNT)**

##### Joint type

Igneous=.JNTI.  
     plutonic=.JNTIP.  
     volcanic=.JNTIV.  
 Sedimentary=.JNTS.

##### Orientation of dip

inclined=.INCJ.  
 vertical=.VERJ.

##### Data integrity

strike and dip measured at site=.SDPM.  
 strike and dip approximate=.SDPA.  
     strike and dip direction indicated but not measured=.SDPAI.  
     strike and dip estimated=.SDPAE.  
         strike and dip estimated from binocular observation=.SDPAEB.  
         strike and dip estimated from aerial photographs=.SDPAEA.

##### Source of data

data compiled from non-USGS sources=.CPD.  
 original USGS data collected by map authors=.ORG.

#### **LINEATION STRUCTURAL SYMBOLS (.LIN)**

##### Lineation type

Lineation, origin not determined=.LINN.  
 geometry not determined=.GND.

Lineation, fault-slip direction=.LINF.

    fault-slip direction, unidirectional=.LINFU.  
         mullion on fault surface=.LINFUM.  
         slickenside on fault surface=.LINFUS.  
     fault-slip direction, bidirectional=.LINFB.  
         striation on fault surface=.LINFBS.  
         groove on fault surface=.LINFBG.

Lineation, high-strain rock=.LINH.

    crushed and streaked mineral grains=.CST.  
     crushed and streaked mineral grains together with aligned mineral grains=.CSA.  
     crushed and streaked mineral grains together with rodding=.CSR.  
     lineation horizontal in plane of inclined foliation=.HRZLI.  
     lineation horizontal in plane of vertical foliation=.HRZLV.

Lineation, igneous=.LINI.

    flow lineation=.LINIF.  
     lineation horizontal in plane of inclined foliation=.HRZLI.  
         aligned mineral grains=.AMGI.  
     lineation horizontal in plane of vertical foliation=.HRZLV.  
         aligned mineral grains=.AMGI.

Lineation, metamorphic=.LINM.

    lineation horizontal in plane of inclined foliation=.HRZLI.  
         aligned mineral grains=.AMGM.  
     lineation horizontal in plane of vertical foliation=.HRZLV.  
         aligned mineral grains=.AMGM.  
     intersection of foliation and cleavage, metamorphic=.IFC.

Lineation, minor-fold axis=.LINA.

    minor-fold axis in high-strain rock=.LINAH.  
     minor-fold axis in igneous rock=.LINAI.  
     minor-fold axis in metamorphic rock=.LINAM.  
     minor-fold axis in sedimentary rock=.LINAS.  
         fold form  
             antiformal=.AFL.  
             synformal=.SFL.  
         geometry not determined=.GND.  
         kink-band fold=.KKF.  
         rootless fold hinge=.RFH.  
             antiformal=.RFHA.  
             synformal=.RFHS.  
         rotation indicator=.ROT.  
             rotation sense not determined=.ROTN.  
             rotation sense, dextral=.ROTD.  
             rotation sense, sinistral=.ROTS.

Lineation, sedimentary=.LINS.

    paleocurrent direction=.PAL.  
         bidirectional=.PALB.  
             glacial striation=.PALBG.  
             sole mark=.PALBS.  
         unidirectional=.PALU.  
             cross bedding=.PALUX.  
             clast imbrication=.PALUC.  
     intersection of bedding and cleavage=.IBC.

boudinage=.BDG.

    geometry not determined=.GND.  
     rodding=.ROD.  
     two lineations normal to each other=.LINT.

two parallel lineations=.TLNP.

Source of data

data compiled from non-USGS sources=.CPD.  
original USGS data collected by map authors=.ORG.

**MASSIVE-TEXTURE STRUCTURAL SYMBOLS (.MTX.)**

Massive texture=.MTX.

Data integrity

strike and dip measured at site=.SDPM.

Source of data

data compiled from non-USGS sources=.CPD.  
original USGS data collected by map authors=.ORG.

**OBSERVATION-STATION SYMBOLS (.OST.)**

Observation-station type=.OST.

annotation site=.OSTA.  
fossil collection=.OSTFC.  
fossil description=.OSTFD.  
fossils observed=.OSTFO.  
general observation=.OSTG.  
geochemistry determination=.OSTC.  
isotopic-age determination=.OSTI.  
gravity determination=.OSTV.  
lithologic description=.OSTL.  
magnetic-susceptibility determination=.OSTU.  
modal-mineralogy determination=.OSTM.  
    stained-slab determination=.OSTMS.  
    thin-section determination=.OSTMT.  
paleomagnetic determination=.OSTP.  
soil profile described=.OSTSD.  
soil profile examined=.OSTSE.  
subsurface-boring site=.OSTB.

Source of data

data compiled from non-USGS sources=.CPD.  
original USGS data collected by map authors=.ORG.



## **PONT-ATTRIBUTE CODES (alphabetic listing by specific keywords)**

### **Version 1.0**

#### **U.S. Geological Survey, Southern California Areal Mapping Project**

aligned mineral grains=.AMG.  
aligned mineral grains in high-strain rock=.AMGH.  
aligned mineral grains in igneous rock=.AMGI.  
aligned mineral grains in metamorphic rock=.AMGM.  
aligned mineral grains in sedimentary rock=.AMGS.  
annotation balloon containing fault information=.PAFA.

antiformal minor-fold-axis lineation=.AFL.

approximate determination of strike and dip=.SDPA.  
approximate determination of strike and dip, aerial photographic estimate=.SDPAEA.  
approximate determination of strike and dip, binocular estimate=.SDPAEB.

Archean=.PRCA.  
Archean, early=.PRCAE.  
Archean, late=.PRCAL.  
Archean, middle=.PRCAM.

bar and ball on down-dropped fault block=.PAFB.

bedding=.BED.  
bedding, sedimentary=.BEDS.  
bedding, volcanogenic=.BEDV.  
boudinage=.BDG.

Cambrian=.PZOC.  
Cambrian, early=.PZOCE.  
Cambrian, late=.PZOCL.  
cataclastic foliation or lineation=.SDOC.  
Cenozoic=.CZO.  
clast imbrication=.PALUC.

cleavage=.CLV.  
cleavage, one cleavage=.CLVO.  
cleavage, two cleavages=.CLVT.  
compiled data=.CPD.

contact attribute=.PAC.  
contact attribute, dip direction=.PACD.  
contact attribute, clearly observable=.PACO.  
contact attribute, clearly observable, knife-edge=.PACOK.  
contact attribute, clearly observable, transitional over 1 to 10 meters=.PACOT.  
contact attribute, clearly observable, gradational over 1 to 10 meters=.PACOG.

crenulated foliation (metamorphic foliation)=.FOLMUC.  
crenulated foliation=.FOLMUC.  
Cretaceous=.MZOK.  
Cretaceous, early=.MZOKE.  
Cretaceous, late=.MZOKL.  
crinkled foliation (metamorphic foliation)=.FOLMUK.  
cross bedding=.PALUX.  
crushed and streaked mineral grains=.CST.  
cumulate foliation=.FOLIC.

data-integrity information, strike-and-dip direction=.SDP.  
data-integrity information, strike-and-dip direction, measured at site=.SDPM.

data-integrity information, strike-and-dip direction, approximated=.SDPA.  
 data-integrity information, strike-and-dip direction, approximated, indicated but not measured=.SDPAI.  
 data-integrity information, strike-and-dip direction, approximated, estimated but not measured=.SDPAE.  
 data-integrity information, strike-and-dip direction, approximated, estimated from binocular observation=.SDPAEB.  
 data-integrity information, strike-and-dip direction, approximated, estimated from aerial photographs=.SDPAEA.

Devonian=.PZOD.  
 Devonian, early=.PZODE.  
 Devonian, late=.PZODL.  
 dextral rotation=.ROTD.  
 dip-direction, faults=.PAFD.  
 dip direction, geologic contact=.PACD.

Eocene=.CZOTE.  
 Eocene, early=.CZOTEE.  
 Eocene, middle=.CZOTEM.  
 Eocene, late=.CZOTEL.  
 estimated=.SDPAE.

facing unknown=.FADU.

fault-attribute type=.PAF.  
 fault-attribute type, annotation balloon=.PAFA.  
 fault-attribute type, bar and ball on down-dropped fault block=.PAFB.  
 fault-attribute type, fault dip-direction=.PAFD.  
 fault-attribute type, strike-slip arrows=.PAFS.  
 fault-attribute type, strike-slip arrows, left lateral=.PAFSL.  
 fault-attribute type, strike-slip arrows, right lateral=.PAFSR.

flow foliation in igneous rock=.FLW.  
 flow lineation in igneous rock=.LINIF.

fold attribute=.PAO.  
 fold attribute, anticline=.PAOAC.  
 fold attribute, antiform=.PAOAF.  
 fold attribute, refolded fold=.PAOR.  
 fold attribute, refolded fold, fold form not determined=.PAORN.  
 fold attribute, refolded fold, fold form determined=.PAORD.  
 fold attribute, refolded fold, fold form determined, antiformal syncline=.AFS.  
 fold attribute, refolded fold, fold form determined, synformal anticline=.SFA.  
 fold attribute, syncline=.PAOSC.  
 fold attribute, synform=.PAOSF.

foliation=.FOL.  
 foliation, igneous=.FOLI.  
 foliation, igneous, cumulate foliation=.FOLIC.  
 foliation, igneous, flow foliation=.FLW.  
 foliation, igneous, plutonic foliation=.FOLIP.  
 foliation, igneous, plutonic foliation, oriented mineral grains=.FOLIPM.  
 foliation, igneous, plutonic foliation, oriented schlieren=.FOLIPS.  
 foliation, igneous, plutonic foliation, oriented xenoliths=.FOLIPX.  
 foliation, igneous, volcanic foliation=.FOLIV.  
 foliation, igneous, volcanic foliation, oriented lapilli=.FOLIVL.  
 foliation, metamorphic=.FOLM.  
 foliation, metamorphic, undulatory foliation=.FOLMU.  
 foliation, metamorphic, crenulated foliation=.FOLMUC.  
 foliation, metamorphic, gneissosity=.FOLMG.  
 foliation, metamorphic, crinkled foliation=.FOLMUK.  
 foliation, metamorphic, schistosity=.FOLMS.  
 foliation, metamorphic, wavy foliation=.FOLMUW.  
 foliation, strain dominated=.FOLD.  
 foliation, strain dominated, cataclastic foliation=.SDOC.

foliation, strain dominated, mylonitic foliation=.SDOM.  
 foliation, origin not determined=.FOLN.  
 foliation, origin not determined, gneissose foliation=.FOLNG.  
 foliation, origin not determined, mineral foliation=.FOLNM.

fossil collection=.OSTFC.  
 fossil description=.OSTFD.  
 fossils observed=.OSTFO.

general observation=.OSTG.  
 geochemistry determination=.OSTC.

geologic-age criteria and basis, fossil age=.FSL.  
 geologic-age criteria and basis, fossil age, age is certain=.FSLC.  
 geologic-age criteria and basis, fossil age, age is uncertain=.FSLU.  
 geologic-age criteria and basis, isoptopic age=.IAG.  
 geologic-age criteria and basis, isoptopic age, age is certain=.IAGC.  
 geologic-age criteria and basis, isoptopic age, age is uncertain=.IAGU.  
 geologic-age criteria and basis, geomorphic development=.GMD.  
 geologic-age criteria and basis, geomorphic development, age is certain=.GMDC.  
 geologic-age criteria and basis, geomorphic development, age is uncertain=.GMDU.  
 geologic-age criteria and basis, intrusive relations=.INR.  
 geologic-age criteria and basis, intrusive relations, age is certain=.INRC.  
 geologic-age criteria and basis, intrusive relations, age is uncertain=.INRU.  
 geologic-age criteria and basis, paleomagnetism=.PMG.  
 geologic-age criteria and basis, paleomagnetism, age is certain=.PMGC.  
 geologic-age criteria and basis, paleomagnetism, age is uncertain=.PMGU.  
 geologic-age criteria and basis, pedogenic-soil development=.SOD.  
 geologic-age criteria and basis, pedogenic-soil development, age is certain=.SODC.  
 geologic-age criteria and basis, pedogenic-soil development, age is uncertain=.SODU.  
 geologic-age criteria and basis, regional correlation=.RCO.  
 geologic-age criteria and basis, regional correlation, age is certain=.RCOC.  
 geologic-age criteria and basis, regional correlation, age is uncertain=.RCOU.  
 geologic-age criteria and basis, stratigraphic relations=.SRL.  
 geologic-age criteria and basis, stratigraphic relations, age is certain=.SRLC.  
 geologic-age criteria and basis, stratigraphic relations, age is uncertain=.SRLU.  
 geologic-age criteria and basis, tephrochronology=.TEP.  
 geologic-age criteria and basis, tephrochronology, age is certain=.TEPC.  
 geologic-age criteria and basis, tephrochronology, age is uncertain=.TEPU.

geologic-contact attribute=.PAC.  
 geologic-contact attribute, dip direction=.PACD.  
 geologic-contact attribute, clearly observable=.PACO.  
 geologic-contact attribute, clearly observable, knife-edge=.PACOK.  
 geologic-contact attribute, clearly observable, transitional over 1 to 10 meters=.PACOT.  
 geologic-contact attribute, clearly observable, gradational over 1 to 10 meters=.PACOG.

geometry not determined, lineation and (or) fold axial plane=.GND.  
 glacial striation=.PALBG.  
 gneissose foliation (origin not determined)=.FOLNG.  
 gneissosity (metamorphic foliation)=.FOLMG.  
 gradational geologic-contact attribute=.PACOG.  
 groove on fault surface=.LINFBG.

Holocene=.CZOQH.  
 Holocene, early=.CZOQHE.  
 Holocene, late=.CZOQHL.  
 Holocene, middle=.CZOQHM.

horizontal planar or linear element=.HRZ.  
 horizontal planar or linear element, bedding=.HRZB.  
 horizontal planar or linear element, cleavage=.HRZC.

horizontal planar or linear element, foliation=.HRZF.  
 horizontal planar or linear element, jointing=.HRZJ.  
 horizontal planar or linear element, lineation=.HRZL.  
 horizontal planar or linear element, lineationhorizontal in plane of inclined foliation=.HRZLI.  
 horizontal planar or linear element, lineationhorizontal in plane of vertical foliation=.HRZLV.

igneous foliation=.FOLI.  
 igneous lineation=.LINI.  
 igneous lineation, flow related=.LINIF.  
 imbrication, clast=.PALUC.

inclined planar or linear element=.INC.  
 inclined planar or linear element, bedding=.INCB.  
 inclined planar or linear element, cleavage=.INCC.  
 inclined planar or linear element, foliation=.INCF.  
 inclined planar or linear element, jointing=.INCJ.  
 inclined planar or linear element, lineation=.INCL.

intersection of bedding and cleavage=.IBC.  
 intersection of foliation and cleavage=.IFC.  
 isotopic-age station=.OSTI.

joint=.JNT.  
 joint in igneous rock=.JNTI.  
 joint in igneous rock, plutonic=.JNTIP.  
 joint in igneous rock, volcanic=.JNTIV.

Jurassic=.MZOJ.  
 Jurassic, early=.MZOJE.  
 Jurassic, late=.MZOJL.

kink-band fold lineation=.KKF.  
 knife-edge geologic contact attribute=.PACOK.

left-lateral fault arrows=.PAFSL.

lineation=.LIN.

lapilli, oriented=.FOLIVL.  
 lithologic-description station=.OSTL.

magnetic-susceptibility determination=.OSTU.  
 massive texture (igneous)=.MTX.  
 measured=.SDPM.  
 Mesozoic=.MZO.  
 metamorphic foliation=.FOLM.  
 metamorphic lineation=.LINM.  
 mineral grains, oriented=.FOLIPM.  
 minor-fold axis=.LINA.  
 Miocene=.CZOTM.  
 Miocene, early=.CZOTME.  
 Miocene, late=.CZOTML.  
 Miocene, middle=.CZOTMM.  
 Mississippian=.PZOM.  
 Mississippian, early=.PZOME.  
 Mississippian, late=.PZOML.  
 modal-mineralogy determination=.OSTM.  
 modal-mineralogy determination, stained-slab=.OSTMS.  
 modal-mineralogy determination, thin-section=.OSTMT.  
 Modern=.CZOQHD.  
 mullion=.LINFUM.  
 mylonitic foliation or lineation =.SDOM.

## Neogene=-NGN-

observation-station=.OST.  
 observation-station, annotation site=.OSTA.  
 observation-station, fossil collection=.OSTFC.  
 observation-station, fossil description=.OSTFD.  
 observation-station, fossils observed=.OSTFO.  
 observation-station, general observation=.OSTG.  
 observation-station, geochemistry determination=.OSTC.  
 observation-station, isotopic-age determination=.OSTI.  
 observation-station, gravity measurement=.OSTV.  
 observation-station, lithologic description=.OSTL.  
 observation-station, magnetic-susceptibility measurement=.OSTU.  
 observation-station, modal-mineralogy determination=.OSTM.  
 observation-station, stained-slab observation=.OSTMS.  
 observation-station, thin-section observation=.OSTMT.  
 observation-station, paleomagnetic measurement=.OSTP.  
 observation-station, soil profile described=.OSTSD.  
 observation-station, soil profile examined=.OSTSE.  
 observation-station, subsurface-boring site=.OSTB.

Oligocene=.CZOTO.  
 Oligocene, early=.CZOTOE.  
 Oligocene, late=.CZOTOL.  
 one cleavage=.CLVO.  
 Ordovician=.PZOO.  
 Ordovician, early=.PZOOE.  
 Ordovician, late=.PZOOL.  
 original data=.ORG.

overturned planar or linear element=.OVT.  
 overturned planar or linear element, bedding=.OVTB.  
 overturned planar or linear element, cleavage=.OVTC.  
 overturned planar or linear element, foliation=.OVTF.  
 overturned planar or linear element, fold axial plane=.OVTA.  
 overturned planar or linear element, jointing=.OVTJ.  
 overturned planar or linear element, lineation=.OVTL.

Paleocene=.CZOTA.  
 Paleocene, early=.CZOTAE.  
 Paleocene, late=.CZOTAL.  
 paleocurrent direction=.PAL.  
 paleocurrent direction, bidirectional lineation=.PALB.  
 paleocurrent direction, unidirectional lineation=.PALU.  
 Paleogene=-PGN-  
 paleomagnetic-measurement station=.OSTP.  
 Paleozoic=.PZO.  
 Paleozoic, early=-PZOE-  
 Paleozoic, late=-PZOL-  
 Paleozoic, middle=-PZOI-  
 Pennsylvanian=.PZOP.  
 Pennsylvanian, early=.PZOPE.  
 Pennsylvanian, late=.PZOPL.  
 Permian=.PZOR.  
 Permian, early=.PZORE.  
 Permian, late=.PZORL.  
 Pleistocene=.CZOQP.  
 Pleistocene, early=.CZOQPE.  
 Pleistocene, late=.CZOQPL.  
 Pleistocene, middle=.CZOQPM.  
 Pliocene=.CZOTP.

Pliocene, early=.CZOTPE.  
 Pliocene, late=.CZOTPL.  
 plunge direction of fold hinge=.PLD.  
 plutonic foliation or lineation=.FOLIP.  
 plutonic joint=.PLT  
 Precambrian=.PRC.  
 Proterozoic=.PRCP.  
 Proterozoic, early=.PRCPE.  
 Proterozoic, late=.PRCPL.  
 Proterozoic, middle=.PRCPM.  
 pseudotachylite=.SDOP.  
  
 refolded fold=.PAOR.  
 refolded fold, fold form not determined=.PAORN.  
 refolded fold, fold form determined=.PAORD.  
 refolded fold, fold form determined, antiformal syncline=.AFS.  
 refolded fold, fold form determined, synformal anticline=.SFA.  
  
 right-lateral fault arrows=.PAFSR.  
 rodding=.ROD.  
 rootless fold hinge=.RFH.  
 rootless fold hinge, antiformal=.RFHA.  
 rootless fold hinge, synformal=.RFHS.  
 rotation sense not determined=.ROTN.  
  
 schistosity=.FOLMS.  
 schlieren, oriented=.FOLIPS.  
 sedimentary bedding=.BEDS.  
 sedimentary lineation=.LINS.  
 Silurian=.PZOS.  
 Silurian, early=.PZOSE.  
 Silurian, late=.PZOSL.  
 sinistral rotation=.ROTS.  
 slickensides=.LINFUS.  
 soil-profile description station=.OSTSD.  
 soil-profile examination station=.OSTSE.  
 sole mark=.PALBS.  
 strain-dominated foliation=.FOLD.  
 strain-dominated lineation=.LINH.  
  
 strike-and-dip direction=.SDP.  
 strike-and-dip direction, measured at site=.SDPM.  
 strike-and-dip direction, approximated=.SDPA.  
 strike-and-dip direction, approximated, indicated but not measured=.SDPAI.  
 strike-and-dip direction, approximated, estimated but not measured=.SDPAE.  
 strike-and-dip direction, approximated, estimated from binocular observation=.SDPAEB.  
 strike-and-dip direction, approximated, estimated from aerial photographs=.SDPAEA.  
  
 striation on fault surface=.LINFBS.  
 strike-slip fault arrows=.PAFS.  
 subsurface boring site=.OSTB.  
 synformal minor-fold-axis lineation=.SFL.  
  
 Tertiary=.CZOT.  
 tops of beds determined=.FADT.  
 Triassic=.MZOT.  
 Triassic, early=.MZOTE.  
 Triassic, late=.MZOTL.  
 two lineations normal to each other=.LINT.  
 two lineations parallel to each other=.TLNP.  
  
 undulatory foliation, metamorphic=.FOLMU.

upright axial plane=.UPRA.

vertical planar or linear element=.VER.

vertical planar or linear element, bedding=.VERB.

vertical planar or linear element, cleavage=.VERC.

vertical planar or linear element, foliation=.VERF.

vertical planar or linear element, lineation=.VERL.

volcanic foliation or lineation=.FOLIV.

volcanogenic sedimentary rock=.BEDV.

wavy foliation (metamorphic foliation)=.FOLMUW.

wavy or crinkled bedding, sedimentary=.BEDSW.

wavy or crinkled bedding, volcanogenic=.BEDVW.

xenoliths=.FOLIPX.

## POINT-ATTRIBUTE CODES (alphabetic listing by code)

### Version 1.0

#### U.S. Geological Survey, Southern California Areal Mapping Project

.AFL.=lineation, minor-fold axis, antiformal  
 .AFS.=fold attribute, refolded fold, fold form determined, antiformal syncline  
 .AMG.=lineation, aligned mineral grains  
 .AMGH.=lineation, aligned mineral grains (high-strain rock)  
 .AMGI.=lineation, aligned mineral grains (igneous rock)  
 .AMGM.=lineation, aligned mineral grains (metamorphic rock)  
 .AMGS.=lineation, aligned mineral grains (sedimentary rock)

.BDG.=lineation, boudinage  
 .BED.=bedding  
 .BEDS.=bedding, sedimentary  
 .BEDSW.=bedding, sedimentary, wavy or crinkled  
 .BEDV.=bedding, volcanogenic  
 .BEDVW.=bedding, volcanogenic, wavy or crinkled

.CLV.=cleavage  
 .CLVO.=cleavage, one cleavage direction  
 .CLVT.=cleavage, two cleavage directions  
 .CPD.=geologic information compiled from non-SCAMP sources  
 .CSA.=lineation, crushed and streaked mineral grains & aligned mineral grains  
 .CSAH.=lineation, crushed and streaked mineral grains & aligned mineral grains (high-strain rock)  
 .CSAM.=lineation, crushed and streaked mineral grains & aligned mineral grains (metamorphic rock)  
 .CSR.=lineation, crushed and streaked mineral grains & rodding  
 .CSRH.=lineation, crushed and streaked mineral grains & rodding (high-strain rock)  
 .CSRM.=lineation, crushed and streaked mineral grains & rodding (metamorphic rock)  
 .CST.=lineation, crushed and streaked mineral grains  
 .CSTH.=lineation, crushed and streaked mineral grains (high-strain rock)  
 .CSTM.=lineation, crushed and streaked mineral grains (metamorphic rock)  
 .CZO.=geologic age, Cenozoic  
 .CZOQH.=geologic age, Holocene  
 .CZOQHD.=geologic age, Modern  
 .CZOQHE.=geologic age, Holocene, early  
 .CZOQHL.=geologic age, Holocene, late  
 .CZOQHM.=geologic age, Holocene, middle  
 .CZOQP.=geologic age, Pleistocene  
 .CZOQPE.=geologic age, Pleistocene, early  
 .CZOQPL.=geologic age, Pleistocene, late  
 .CZOQPM.=geologic age, Pleistocene, middle  
 .CZOT.=geologic age, Tertiary  
 .CZOTA.=geologic age, Paleocene  
 .CZOTAE.=geologic age, Paleocene, early  
 .CZOTAL.=geologic age, Paleocene, late  
 .CZOTE.=geologic age, Eocene  
 .CZOTEE.=geologic age, Eocene, early  
 .CZOTEL.=geologic age, Eocene, late  
 .CZOTEM.=geologic age, Eocene, middle  
 .CZOTM.=geologic age, Miocene  
 .CZOTME.=geologic age, Miocene, early  
 .CZOTML.=geologic age, Miocene, late  
 .CZOTMM.=geologic age, Miocene, middle  
 .CZOTO.=geologic age, Oligocene  
 .CZOTOE.=geologic age, Oligocene, early  
 .CZOTOL.=geologic age, Oligocene, late  
 .CZOTP.=geologic age, Pliocene  
 .CZOTPE.=geologic age, Pliocene, early  
 .CZOTPL.=geologic age, Pliocene, late



.FAD.=facing direction, point has information about  
 .FADT.=facing direction, tops of beds determined  
 .FADU.=facing direction, unknown  
 .FLW.=foliation, igneous-flow origin  
 .FOL.=foliation  
 .FOLI.=foliation, igneous  
 .FOLIC.=foliation, igneous, cumulate  
 .FOLIP.=foliation, igneous, plutonic  
 .FOLIPM.=foliation, igneous, plutonic, oriented mineral grains  
 .FOLIPS.=foliation, igneous, plutonic, oriented schlieren  
 .FOLIPX.=foliation, igneous, plutonic, oriented xenoliths  
 .FOLIV.=foliation, igneous, volcanic  
 .FOLIVL.=foliation, igneous, volcanic, oriented lapilli  
 .FOLM.=foliation, metamorphic  
 .FOLMG.=foliation, metamorphic, gneissose layering  
 .FOLMS.=foliation, metamorphic, schistose fabric  
 .FOLMU.=foliation, metamorphic, undulatory  
 .FOLMUC.=foliation, metamorphic, undulatory, crenulated  
 .FOLMUK.=foliation, metamorphic, undulatory, crinkled  
 .FOLMUW.=foliation, metamorphic, undulatory, wavy  
 .FOLN.=foliation, origin not determined  
 .FOLNG.=foliation, origin not determined, gneissose  
 .FOLNM.=foliation, origin not determined, mineral foliation  
 .FSL.=geologic-age criteria and basis, fossil age  
 .FSLC.=geologic-age criteria and basis, fossil age, age is certain  
 .FSLU.=geologic-age criteria and basis, fossil age, age is uncertain  
  
 .GMD.=geologic-age criteria and basis, geomorphic development  
 .GMDC.=geologic-age criteria and basis, geomorphic development, age is certain  
 .GMDU.=geologic-age criteria and basis, geomorphic development, age is uncertain  
 .GND.=lineation and (or) fold form, geometry not determined  
  
 .HRZ.=orientation of planar or linear element, horizontal  
 .HRZB.=orientation of planar or linear element, horizontal, bedding  
 .HRZC.=orientation of planar or linear element, horizontal, cleavage  
 .HRZF.=orientation of planar or linear element, horizontal, foliation  
 .HRZJ.=orientation of planar or linear element, horizontal, jointing  
 .HRZL.=orientation of planar or linear element, horizontal, lineation  
 .HRZLI.=orientation of planar or linear element, horizontal in plane of inclined foliation, lineation  
 .HRZLV.=orientation of planar or linear element, horizontal in plane of vertical foliation, lineation  
  
 .IAG.=geologic-age criteria and basis, isoptopic age  
 .IAGC.=geologic-age criteria and basis, isoptopic age, age is certain  
 .IAGU.=geologic-age criteria and basis, isoptopic age, age is uncertain  
 .IBC.=intersection of bedding and cleavage  
 .IFC.=intersection of foliation and cleavage  
 .INC.=orientation of planar or linear element, inclined  
 .INCB.=orientation of planar or linear element, inclined, bedding  
 .INCC.=orientation of planar or linear element, inclined, cleavage  
 .INCF.=orientation of planar or linear element, inclined, foliation  
 .INCL.=orientation of planar or linear element, inclined, jointing  
 .INCLJ.=orientation of planar or linear element, inclined, jointing  
 .INCLL.=orientation of planar or linear element, inclined, lineation  
 .INR.=geologic-age criteria and basis, intrusive relations  
 .INRC.=geologic-age criteria and basis, intrusive relations, age is certain  
 .INRU.=geologic-age criteria and basis, intrusive relations, age is uncertain  
  
 .JNT.=joint  
 .JNTI.=joint in igneous rock  
 .JNTIP.=joint in igneous rock, plutonic  
 .JNTIV.=joint in igneous rock, volcanic  
 .JNTS.=joint in sedimentary rock

.KKF.=lineation, minor-fold axis, kink-band fold

.LIN.=lineation

.LINA.=lineation, minor-fold axis

.LINAH.=lineation, minor-fold axis in high-strain rock

.LINAI.=lineation, minor-fold axis in igneous rock

.LINAM.=lineation, minor-fold axis in metamorphic rock

.LINAS.=lineation, minor-fold axis in sedimentary rock

.LINFBG.=lineation, fault-slip direction, groove on fault surface

.LINFBS.=lineation, fault-slip direction, striation on fault surface

.LINFUM.=lineation, fault-slip direction, mullion

.LINFUS.=lineation, fault-slip direction, slickenside on fault surface

.LINH.=lineation in high-strain rock

.LINI.=lineation in igneous rock

.LINIF.=lineation in igneous rock, flow lineation

.LINM.=lineation in metamorphic rock

.LINS.=lineation in sedimentary rock

.LINT.=lineation, two lineations normal to each other

.MTX.=massive texture (igneous)

.MZO.=geologic age, Mesozoic

.MZOJ.=geologic age, Jurassic

.MZOJE.=geologic age, Jurassic, early

.MZOJL.=geologic age, Jurassic, late

.MZOK.=geologic age, Cretaceous

.MZOKE.=geologic age, Cretaceous, early

.MZOKL.=geologic age, Cretaceous, late

.MZOT.=geologic age, Triassic

.MZOTE.=geologic age, Triassic, early

.MZOTL.=geologic age, Triassic, late

-NGN.=geologic age, Neogene

.ORG=geologic information generated by SCAMP

.OST.=observation station

.OSTA.=observation station, annotation site

.OSTB.=observation station, subsurface boring site

.OSTC.=observation station, geochemistry determination

.OSTF.=observation station, fossil information

.OSTFC.=observation station, fossil information, fossil collection

.OSTFD.=observation station, fossil information, fossil description

.OSTFO.=observation station, fossil information, fossils observed

.OSTG.=observation station, general observation

.OSTI.=observation station, isotopic-age determination

.OSTL.=observation station, lithologic description

.OSTM.=observation station, modal-mineralogy determination

.OSTP.=observation station, paleomagnetic determination

.OSTS.=observation station, soil-profile information

.OSTSD.=observation station, soil-profile information, profile described

.OSTSE.=observation station, soil-profile information, profile examined

.OSTU.=observation station, magnetic-susceptibility determination

.OVT.=orientation of planar or linear element, overturned

.OVTA.=orientation of planar or linear element, fold axial plane, overturned

.OVTB.=orientation of planar or linear element, bedding, overturned

.OVTC.=orientation of planar or linear element, cleavage, overturned

.OVTF.=orientation of planar or linear element, foliation, overturned

.OVTJ.=orientation of planar or linear element, jointing, overturned

.OVTL.=orientation of planar or linear element, lineation, overturned

-PGN.=geologic age, Paleogene

-PZOE.=geologic age, Paleozoic, early

-PZOI=geologic age, Paleozoic, middle  
 -PZOL=geologic age, Paleozoic, late  
 .PAC=geologic contact attribute  
 .PACD=geologic contact attribute, dip direction and amount  
 .PACO=geologic contact attribute, observable  
 .PACOG=geologic contact attribute, observable, gradational  
 .PACOK=geologic contact attribute, observable, knife-edge  
 .PACOT=geologic contact attribute, observable, transitional  
 .PAF=fault attribute  
 .PAFA=fault attribute, annotation balloon containing information  
 .PAFB=fault attribute, bar and ball on down-dropped fault block  
 .PAFD=fault attribute, fault-dip direction  
 .PAFS=fault attribute, strike-slip arrows  
 .PAFSL=fault attribute, strike-slip arrows, left-lateral  
 .PAFSR=fault attribute, strike-slip arrows, right-lateral  
 .PAL=paleocurrent lineation  
 .PALB=paleocurrent lineation, bidirectional  
 .PALBG=paleocurrent lineation, bidirectional, glacial striation  
 .PALBS=paleocurrent lineation, bidirectional, sole mark  
 .PALU=paleocurrent lineation, unidirectional  
 .PALUC=paleocurrent lineation, unidirectional, clast imbrication  
 .PALUX=paleocurrent lineation, unidirectional, cross bedding  
 .PAO=fold attribute, point has information about  
 .PAOAC=fold attribute, anticline  
 .PAOAF=fold attribute, antiform  
 .PAOR=fold attribute, refolded fold  
 .PAORD=fold attribute, refolded fold, fold form determined  
 .PAORN=fold attribute, refolded fold, fold form not determined  
 .PAOSC=fold attribute, syncline  
 .PAOSF=fold attribute, synform  
 .PLD=fold attribute, fold-hinge plunge direction  
 .PMG=geologic-age criteria and basis, paleomagnetism  
 .PMGC=geologic-age criteria and basis, paleomagnetism, age is certain  
 .PMGU=geologic-age criteria and basis, paleomagnetism, age is uncertain  
 .PRC=geologic age, Precambrian  
 .PRCA=geologic age, Archean  
 .PRCAE=geologic age, Archean, early  
 .PRCAL=geologic age, Archean, late  
 .PRCAM=geologic age, Archean, middle  
 .PRCP=geologic age, Proterozoic  
 .PRCPE=geologic age, Proterozoic, early  
 .PRCPL=geologic age, Proterozoic, late  
 .PRCPM=geologic age, Proterozoic, middle  
 .PZO=geologic age, Paleozoic  
 .PZOC=geologic age, Cambrian  
 .PZOCE=geologic age, Cambrian, early  
 .PZOCL=geologic age, Cambrian, late  
 .PZOD=geologic age, Devonian  
 .PZODE=geologic age, Devonian, early  
 .PZODL=geologic age, Devonian, late  
 .PZOM=geologic age, Mississippian  
 .PZOME=geologic age, Mississippian, early  
 .PZOML=geologic age, Mississippian, late  
 .PZOO=geologic age, Ordovician  
 .PZOOE=geologic age, Ordovician, early  
 .PZOOL=geologic age, Ordovician, late  
 .PZOP=geologic age, Pennsylvanian  
 .PZOPE=geologic age, Pennsylvanian, early  
 .PZOPL=geologic age, Pennsylvanian, late  
 .PZOR=geologic age, Permian  
 .PZORE=geologic age, Permian, early  
 .PZORL=geologic age, Permian, late

.PZOS.=geologic age, Silurian  
 .PZOSE.=geologic age, Silurian, early  
 .PZOSL.=geologic age, Silurian, late

.RCO.=geologic-age criteria and basis, regional correlation  
 .RCOC.=geologic-age criteria and basis, regional correlation, age is certain  
 .RCOU.=geologic-age criteria and basis, regional correlation, age is uncertain  
 .RFH.=rootless fold  
 .RFHA.=rootless fold hinge, antiformal  
 .RFHS.=rootless fold hinge, synformal  
 .ROD.=lineation, rodding  
 .RODH.=lineation, rodding (high-strain rock)  
 .RODM.=lineation, rodding (metamorphic rock)  
 .RODS.=lineation, rodding (sedimentary rock)  
 .ROTD.=minor-fold, rotation sense dextral  
 .ROTN.=minor-fold, rotation sense not determined  
 .ROTS.=minor-fold, rotation sense sinistral

.SDO.=strain-dominated foliation  
 .SDOC.=strain-dominated foliation, cataclastic  
 .SDOM.=strain-dominated foliation, mylonitic  
 .SDOP.=strain-dominated foliation, pseudotachylitic  
 .SDP.=strike-and-dip direction  
 .SDPA.=strike-and-dip direction, approximated  
 .SDPAE.=strike-and-dip direction, approximated, estimated but not measured  
 .SDPAEA.=strike-and-dip direction, approximated, determined from aerial photographs  
 .SDPAEB.=strike-and-dip direction, approximated, determined from binocular observation  
 .SDPAI.=strike-and-dip direction, approximated, indicated but not measured  
 .SDPM.=strike-and-dip direction, measured at site  
 .SFA.=fold attribute, refolded fold, fold form determined, synformal anticline  
 .SFL.=lineation, minor-fold axis, synformal  
 .SOD.=geologic-age criteria and basis, pedogenic-soil development  
 .SODC.=geologic-age criteria and basis, pedogenic-soil development, age is certain  
 .SODU.=geologic-age criteria and basis, pedogenic-soil development, age is uncertain  
 .SRL.=geologic-age criteria and basis, stratigraphic relations  
 .SRLC.=geologic-age criteria and basis, stratigraphic relations, age is certain  
 .SRLU.=geologic-age criteria and basis, stratigraphic relations, age is uncertain

.TEP.=geologic-age criteria and basis, tephrochronology  
 .TEPC.=geologic-age criteria and basis, tephrochronology, age is certain  
 .TEPU.=geologic-age criteria and basis, tephrochronology, age is uncertain  
 .TLNP.=two lineations parallel to each other

.UPR.=orientation of planar or linear element, upright  
 .UPRA.=orientation of planar or linear element, fold-axial plane, upright

.VER.=orientation of planar or linear element, vertical  
 .VERB.=orientation of planar or linear element, vertical, bedding  
 .VERC.=orientation of planar or linear element, vertical, cleavage  
 .VERF.=orientation of planar or linear element, vertical, foliation  
 .VERJ.=orientation of planar or linear element, vertical, jointing  
 .VERL.=orientation of planar or linear element, vertical, lineation

## APPENDIX A

### POINT-ATTRIBUTE CODES FOR DIGITAL GEOLOGIC-MAP DATA BASES Version 1.0

#### U.S. Geological Survey, Southern California Areal Mapping Project

#### **Suggestions for searching and selecting using ARC/INFO command-line narratives: How it's done with a SCAMP database**

SCAMP's digital data bases can be searched in a number of ways--each requiring a basic understanding of the database structure in order to take full advantage of ARC/INFO's selection tools. The SCAMP database and coding model is linguistic by nature. Coding is accomplished through the use of alpha-numeric characters separated by a parsing symbol: dots (.) that separate primary attribute data and hyphens (-) that separate supplemental attribute data.

ARC has a number of selection commands that can be employed to access the database:

SELECT	Selects features or data items
ASELECT	Adds to your selected set of items or features
UNSELECT	Removes selected features from your group of selected items.
RESELECT	Selects a subset of items out of your group of selected items.
NSELECT	Unselects all of your currently selected items and selects all those you did not have selected.

All of the selection commands except for NSELECT can be used in conjunction with logical expressions of operators and connectors so that you can select for or against any item that is coded in the database.

Table1 illustrates some ways to search the geologic-point data base. The examples use the data-base field P-DEF that contains code sentences for two different point types (Item 1 and Item 2), :

	Item 1	Item 2
P-DEF:	.SDE.ESE.TES.ZXE.SEES.MESE.	.SDE.ESE.TES.ZXE.SEEB.MEII.

For Items 1 and 2 the two code sentences clearly are related, but they differ slightly in their last two codes.

Expression	Example	Explanation
CN	Select POINTS.REL//P-DEF cn '.SEES.'	This is a whole-word search that would select Item 1 above
CN	Select POINTS.REL//P-DEF cn '.SEE	This is a prefix search that will select all items containing a word with the prefix <b>.SEE</b> . In this case, both items 1 and 2 would be selected

Table 1

The user can substitute any operator or connector to search for and/or against any combination of items coded in the database. Some of the operators and connectors that are useful include:

## Operators:

CN	Contains
NC	Not containing
LK	Contains something like

## Connectors:

AND	Only items for which the expressions on both side of the AND are true will be selected
OR	Items for which the expressions on either side of the OR will be selected
XOR	Items for which ONLY one of the expressions on either side of the XOR are true will be selected